DEPARTMENT OF
SCIENTIFIC AND INDUSTRIAL RESEARCH
NEW ZEALAND

AUCKLAND INSTITUTE
27 JAN 1977
AND MUSEUM LIBRARY

BOTANY DIVISION

1972-75

TRIENNIAL REPORT

DEPARTMENT OF
SCIENTIFIC AND INDUSTRIAL
RESEARCH

BOTANY DIVISION
CHRISTCHURCH, NEW ZEALAND

CHRISTCHURCH
1976

With the Compliments of

the Director, Botany Division,

Department of Scientific and Industrial

Research

Private Bag

Christchurch

New Zealand

S.I.R. BYD 9

DEPARTMENT OF
SCIENTIFIC AND INDUSTRIAL
RESEARCH

BOTANY DIVISION

CHRISTCHURCH - NEW ZEALAND

Postal address: Botany Division
DSIR, Private Bag, Christchurch
Telegrams: Botany, Christchurch. Telephone 22-8019

North Island Substations:
c/o Plant Diseases Division, DSIR
Private Bag, Auckland

c/o Soil Bureau, DSIR
Private Bag, Lower Hutt

South Island Substations:
Private Bag, Nelson

P.O. Box 5306, Dunedin

CHRISTCHURCH
1976

ISSN 0077-9636

PREVIOUS REPORTS

1957-59 (not numbered)

1960-62 (DSIR INFORMATION SERIES No. 39)

1963-65 (DSIR INFORMATION SERIES No. 59)

1966-68 (DSIR INFORMATION SERIES No. 72)

1969-71 (DSIR INFORMATION SERIES No. 93)

THE CAXTON PRESS CHRISTCHURCH

UNDER THE AUTHORITY OF

A. R. SHEARER, Government Printer, Wellington, New Zealand

CONTENTS

	page
Introduction	5
Functions and Location	8
The Herbarium	9
The Library	14
The Experimental Gardens	15
Research Projects	
Taxonomy	17
Poisonous Plants	29
Pacific Islands	29
Ecology and Conservation	31
Unpublished Reports Relating to Ecology and Conservation	45
Palynology and Quaternary Botany	50
Seed	56
Morphology and Anatomy	57
Cytology and Genetics	58
General Advisory and Servicing Work	61
Botanical Illustrations	63
Publications	64
Staff	
Honours and Awards	78
Overseas Visits	78
Overseas Visitors	79
Committees and Appointments	80
Retirements and Resignations	81
Transfers	82
Staff Replacements	82
New Positions	82
Staff List	83

NEW ZEALAND
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Information Series No. 121

INTRODUCTION

In 1976 the New Zealand Department of Scientific and Industrial Research celebrates its fiftieth birthday. The general background to the origin and development of Botany Division will be found in "DSIR's First Fifty Years" by Dr J. D. Atkinson (N.Z. DSIR Information Series No. 115). A more detailed account of the history of the Division will be given in our next Triennial Report which will coincide with our fiftieth birthday in 1978. In the meantime this introduction is confined to developments and relevant history over the last three years.

Mr A. J. Healy first worked for the Division in 1940 and was appointed Assistant-Director in 1949. He has assisted with distinction three Directors in turn: Mr A. L. Poole, Mr C. M. Smith and Dr E. J. Godley. However because of Mr Healy's unanticipated retirement in 1977, and his unrivalled knowledge of adventive plants, completion of the third volume of the "Flora of New Zealand" loomed large in our minds. And in 1974, by mutual agreement, he was freed from distractions of administration to concentrate on this work. He was replaced by Mr H. E. Connor, who joined the Department in 1940 and Botany Division in 1942.

The period under review has seen the retirement of three officers who have spent most or all of their working life at the Division, and have made very important contributions to the plant sciences in New Zealand. A brief account of their work will show the diversity of tasks that they undertook.

Miss Ruth Mason joined Botany Division in January 1939, as Botanist Assistant. Her experience in microscope work while studying *Griselinia lucida* for an M.Sc. thesis at Auckland University College led to some of her first tasks. In 1941 she studied methods of making chromosome counts with Dr O. H. Frankel at the Wheat Research Institute, Lincoln, with a view to assisting a proposed taxonomic study of *Acaena*. With war work expanding Miss Mason worked at Washdyke in 1943, sectioning stems of linen flax to study the quality of fibres in crops from different soil types. During this time Miss Mason also began the work on which she concentrated for the remainder of her career. She built up the seed herbarium and began the study of plant fragments, both adjuncts to her work on the identification of foods of wildlife, often from stomach contents. And this also involved an interest in the taxonomy, distribution and ecology of aquatic plants, subjects on which she published much and was the acknowledged expert. Of considerable importance too, was Miss Mason's ability as a collector. Her specimens were carefully gathered and meticulously prepared, and represent a store of information invaluable to experts studying our plants. As an example, Miss Mason's specimens of charophytes finally came into their own when Professor and Mrs R. D. Wood visited Botany Division in 1975 to study the family with her.

Dr J. B. Hair first worked on plant chromosomes under Dr O. H. Frankel for an M.Sc. thesis on *Hebe* and its relatives, presented in 1934. After working as plant breeder with the Grasslands Division, plant geneticist with the Wheat Research Institute, and mycologist with Plant Diseases Division (interrupted by war service overseas) he joined Botany Division in 1947 as cytologist, and was at last able to concentrate on his chosen field. His first task was to study the chromosomes of the races of *Agropyron scabrum* then being sorted out by Henry Connor as part of a programme to assess the value of this native grass. In late 1948 Dr Hair took material to the John Innes Horticultural Institute for doctoral study and made valuable investigations in *Agropyron* on the origin of new chromosomes and on subsexual reproduction, as well as gaining experience with chromosomes of other genera.

On his return in September 1952, he began, with the assistance of Mr E. J. Beuzenberg, a systematic examination of the chromosomes of the indigenous flowering plants of New Zealand. At the time of his retirement fifteen contributions to a chromosome atlas of the New Zealand flora had been published. This was a major project, excellently planned, each determination supported by a voucher specimen, and all showing evidence of John Hair's great patience and skill in disclosing the chromosomes in often fickle and recalcitrant material. Other important work included chromosomal evolution in *Cotula* and (with Mr Beuzenberg) in the *Podocarpaceae*. Dr Hair still visits the Division regularly and is writing up further work.

Mr T. W. Rawson worked before the war as a cadet at Pukekura Park, New Plymouth, and after being in charge of glasshouses moved to the State Forest nurseries at Golden Downs, Nelson and then Rotorua. In 1944 on his return from service overseas he worked on the National Forest Survey and then began his B.Sc. studies at Victoria University College in 1945. In November 1945 he joined Botany Division with the task of reorganising the herbarium, and in 1948 was appointed Herbarium Keeper. He completed his M.Sc. degree in 1951 with a thesis on "The taxonomic status of New Zealand Veronicas". During Mr Rawson's time as Keeper, the herbarium had two major moves: from Wellington to Christchurch in 1954, and from Christchurch to Lincoln in 1960; and it also graduated from cardboard boxes to steel cabinets, from makeshift quarters to a permanent building, and more than tripled in size. During his latter years with us Mr Rawson devoted much time to sorting, labelling and classifying the lichen collection.

Dr D. G. Drury joined us in 1967 after completing a Ph.D. thesis at the University of Southampton in which he used computer techniques to study classification in the Compositae. During his all too brief time with us he produced several valuable papers on the taxonomy of some of the difficult groups of native and adventive composites. He resigned from DSIR in 1974 to take up teaching.

These retirements, and those of Dr L. B. Moore and Mr V. D. Zotov in the preceding few years, meant that the staff of Botany Division has had to be rebuilt. We have been fortunate in recruiting the following younger botanists: in ecology, Dr G. N. Park, Dr P. N. Johnson, Mr P. A. Williams and Mr S. R. June; in taxonomy, Dr P. J. Garnock-Jones and Dr C. J. Webb; and in palynology Mr M. S. McGlone. We have also filled some long-standing gaps by the appointment of Mr R. N. Patel as anatomist, Dr D. J. Galloway as lichenologist, and Dr U. V. Cassie as phycologist.

Botany Division was not conceived as a survey, like the Geological or Soil Surveys of DSIR. However vegetation survey work has gradually increased, and the earlier work that we were able to do, and the nucleus of ecologists that we assembled, have come into their own over the last few years with the increasing concern for environmental matters. One of our aims has been to build up the survey work by appointing regional botanists. The ultimate aim is to have one or more botanists responsible for each of the land districts defined by the Department of Lands and Survey. The regional representation at present, with the year of establishment is as follows:

1. Headquarters (Lincoln): responsible for Canterbury, southern Marlborough and southern Westland.

2. Wellington (1960): located at Soil Bureau, Taita, and responsible for Wellington, Hawkes Bay and Taranaki.

3. Auckland (1969): located at Plant Diseases Division, Mt Albert, and responsible for North Auckland, South Auckland, and Gisborne if necessary.

4. Dunedin (1973): located in rented buildings with units of Soil Bureau and Geological Survey; responsible for Otago, Southland and Stewart Island.

5. Nelson (1975): located in the old Entomology Division buildings with units of Geological Survey, Soil Bureau and Ecology Division; responsible for Nelson, northern Westland and northern Marlborough.

The coverage is still thin, particularly as each regional station is also responsible for local plant identification and advice, as well as assistance to the police. Better coverage is needed in east, central and west North Island and the possibility of a regional botanist nearer central North Island is being considered.

The extension to the two-storey east wing was completed in 1973. On the ground floor this provided 3 extra offices for Botany Division as well as laboratories for anatomy and seed germination; and on the first floor extra offices and laboratories for the substations of Entomology and Grasslands Divisions.

Staff numbers and finance were as follows:

	1972-73	1973-74	1974-75
Permanent Staff Ceiling	41	45	46
Salaries	$279,800	$326,300	$371,800
Other Expenditure	$68,900	$72,700	$93,800
Total Expenditure	$348,700	$399,000	$465,600
Voted	$345,900	$367,100	$443,100

FUNCTIONS AND LOCATION

The main function of Botany Division is to study the plants of New Zealand. We seek to describe and classify the native, adventive and horticultural flora, and to describe the vegetation whether old or new, past or present. To facilitate these aims, research is also carried out in genetics, cytology, anatomy, morphology, palynology and ecology. The information obtained is made widely available both here and overseas.

The Division's headquarters is near the township of Lincoln, 23 km south-west of Christchurch in the South Island.

Location	Latitude 43° 38′ S. Longitude 172° 30′ E. Height above sea level 11.0 m.
Soil	Headquarters Block. Wakanui silt loam on sand, mottled phase. East Block. Templeton silt loam and Eyre shallow silt loam with stones in places.
Rainfall	662.9 mm per annum on 122 days. Distribution erratic, late spring droughts common.
Mean Evap.	932.4 mm per annum (11 years).
Rainfall/Evap.	0.711.
Temperature	Mean Maximum 16.5°C. Mean Minimum 5.6°C. Mean 11.0°C.
Humidity	74% (at 9.00 a.m.).
Days of ground frosts	88.6.
Hours of sunshine	2004.

The Substations are listed in the introduction.

THE HERBARIUM

(International Code, CHR)

(*Herbarium Keeper*, Dr D. R. Given)

The entire herbarium of the Canterbury Museum (CANTY) was transferred to the Botany Division, in May, 1975. It contains about 8,000 sheets of vascular plants which are being included in the Botany Division folders, distinguished by a label stating the date of transfer.

The Museum herbarium was established by Julius von Haast in the 1860s and the principal collectors are J. von Haast, J. B. Armstrong, T. Kirk, T. F. Cheeseman, J. D. Enys, D. Petrie, L. Cockayne, R. M. Laing, H. J. Matthews, A. Wall, W. R. B. Oliver. In 1930 the Museum received the herbarium of H. Carse of Auckland, who collected chiefly in North Auckland and received vascular plants from correspondents in many parts of New Zealand. Although an amateur Carse was very active in taxonomy and between 1918 and 1930 he described 33 taxa.

Approximately 1,500 sheets were received by the Museum from European sources, in particular Scandinavian material from S. Berggren, and Transylvanian material from E. Fenzl.

The moss herbarium of T. W. N. Beckett (1839-1906) of Christchurch, was given to the Museum by his family in the early 1960s. It is now maintained at the Botany Division as a separate unit and comprises about 3,000 New Zealand specimens, and 9,000 foreign specimens obtained by exchange with correspondents in Europe, North and South America, Asia, Pacific Islands, Africa and Australia.

The Armstrong Herbarium (1863-1923) which was on loan to the Canterbury Museum has returned to the Christchurch Botanic Gardens (CHBG).

Emphasis has been on the incorporation of specimens collected by the ecologists at Substations and Headquarters during survey work, and on an increased foreign exchange programme. Especially large numbers have been contributed by Mr A. P. Druce, from Egmont National Park, central North Island ranges and NW Nelson ranges. Mr H. D. Wilson's collection from Mount Cook National Park of *c.* 2,500 sheets of vascular plants and cryptogams, was laid in at Lincoln.

With an average annual intake of 10,000 sheets and an estimated total of 260,000 specimens, it has become necessary to plan for extensions. A two-floored addition to the herbarium with working area and staff offices has been designed, allowing for possible use of compactum storage units.

Pacific Island floras have been increased by large collections from Norfolk Island and the Cook Islands made by Mr W. R. Sykes. South Andean and subantarctic representation has been increased through the gifts acknowledged below.

We are most grateful for the following collections:

Mr F. C. Allen	Norfolk Island vascular plants.
Mr K. W. Allison	Bryophyte herbarium of 18,000 packets.
Dr & Mrs R. E. Beever	Atuanui State Forest, North Auckland.
Mr W. B. Brockie	Campbell Island.
Dr G. Brownlie	Ferns, Cook Islands.
Mr D. J. Campbell	Auckland Islands.
Mr R. J. Chinnock	Ferns, Norfolk Island; *Carobrotus* and *Disphyma*.
Miss J. Davison	Alpine plants from Patagonia.
Dr A. R. Ferguson	General herbarium.
Dr R. M. Greenwood	Lord Howe Island.
Mrs E. A. Hodgson	Angiosperm herbarium.
Dr D. S. Horning	Cryptogams from Auckland Island, Solander Island, Stewart Island.
Mr D. W. Ives	Indonesia.
Mr J. R. Le Comte	South Island mountains.
Mr W. Martin	Lichen herbarium.
Miss R. Mason	Swedish aquatic specimens.
Dr D. M. Moore	Tierra del Fuego.
Dr I. M. Morice	Marquesas Islands, Tuamotu Islands and Tahiti.
Mr G. B. Rawlings	North Auckland.
Mrs K. Reynolds	*Pseudopanax*.
Mr A. Rockell	General herbarium.
Mr W. Sander	Simmonds Island, Hauraki Gulf Maritime Park.
Mr E. J. Stevens	Molesworth.
Mr H. Talbot	His private herbarium, especially rich in specimens from Waimakariri Basin and Nelson.
Dr N. M. Wace	Tristan da Cunha and Gough Island.

Mr & Mrs R. H. Ward	Little Barrier Island and Wellington District.
Mr H. D. Wilson & Mr J. M. Wilson	Peruvian Andes.
Department of Botany, University of Canterbury	New Guinea material especially Araliaceae. Foreign bryophytes.
Department of Botany, University of Otago	Final part of the herbarium of Mr G. Simpson, Dunedin.
Department of Botany, University of Tasmania	Compositae.
Botanical Museum, Oslo	Tristan da Cunha, set from Norwegian Expedition 1937-38.
Canterbury Botanical Society	Mt St Patrick and Mt Hutt.
Fiordland National Park	Chalky Island specimens collected by A. Cragg.
Forest Research Institute, Rotorua	Leonard Cockayne collection of *Nothofagus* hybrids. New Hebrides.
Grasslands Division, DSIR, Palmerston North	*Leptospermum,* D. Grant collection *Bromus* vouchers. Pacific Island grasses.
Mount Cook National Park	The herbarium from the botanical survey by Mr H. D. Wilson.
Wildlife Service, Department of Internal Affairs	Chatham Islands. Vascular plant herbarium.

Over 50 loans to and from the herbarium have been handled annually, the larger ones being in *Senecio, Lagenophora, Cortaderia, Luzula* and *Asplenium.*

Exchange of duplicate specimens was continued or initiated with 55 herbaria, in order to build up our foreign component. Some of the larger consignments were received from:

University of Alberta, Edmonton — bryophytes.
Auckland Institute and Museum.
L. H. Bailey Hortorium, Ithaca—cultivated plants.
Ubersee Museum, Bremen.
California Academy of Sciences, San Francisco — cultivated plants.
National Museum of Canada, Ottawa.

CSIRO, Canberra.
Compton Herbarium, Kirstenbosch.
Royal Botanic Gardens, Kew.
Kyoto University — ferns.
Museo de La Plata.
Rijksherbarium, Leiden—New Guinean specimens.
Missouri Botanical Garden.
National Herbarium, New South Wales.
Polish Academy of Sciences, Krakow.
National Museum, Prague.
Charles University, Prague.
Botanic Gardens, Singapore.
University of Tokyo.
National Science Museum, Tokyo.
United States National Arboretum, Washington — cultivated plants.
Wisconsin State University.

Exchange of specimens was facilitated by large collections of woody cultivated plants made by Mr W. R. Sykes, sets of fern duplicates made by Dr D. R. Given, and about 160 sets of indigenous vascular plants totalling over 3,000 specimens made by Miss E. M. Chapman, which were sent to 20 overseas herbaria.

Collections for the herbarium were made in beech-podocarp forest near Reefton; on mountains in the upper Hurunui River; at Lakes Sumner and Pukaki, and in the Hunter Hills, South Canterbury.

Algae (Dr M. J. Parsons)

The re-organisation and curation of the main algal collections continues, concentrating on the red algae of New Zealand (mainly the Ceramiales) so that New Zealand research workers will be able to study this material. With student help, the main New Zealand collections have been placed in new, clearly labelled folders, although much remounting remains to be done. The overseas exsiccatae in our collections, for some years inaccessible, have been sorted, listed, mounted and placed in new folders arranged so that full use can now be made of some 2,500 specimens.

New general collections have been added, mainly from Kaikoura and Oaro on the east coast of the South Island, and from Russell and Leigh in North Auckland. Generous amounts of liquid preserved material of these New Zealand collections are being kept for later detailed study.

The first algal collections from Solander Island (17 November 1973) were presented to us by Dr P. N. Johnson.

During the last three years, Dr D. S. Horning and Mr J. K. Lowry have deposited extensive collections of algae from Auckland Islands. These seaweeds originally collected because of the interest in the small animals that live in them, will be very worthwhile additions to our sub-

antarctic material. They are in formalin and have yet to be sorted and mounted.

A valuable diatom slide collection belonging to the late Mr A. Cunningham of Oamaru was given to the herbarium by Waitaki Boys' High School.

Well prepared exsiccatae from Prof. H. B. S. Womersley of Adelaide University, South Australia (141 specimens containing some isotypes) and Dr G. R. South and Mr R. Hooper of Memorial University, St John's, Newfoundland (Set V Nos. 83-102, Set VI Nos. 103-122, and Set VIII Nos. 123-150) have been received and are available for study. The Flint Collection of freshwater and terrestrial algae.

This collection, now housed at Botany Division herbarium, began in November 1965 when Dr Elizabeth A. Flint presented some seven collections of freshwater algae. Over the years Dr Flint has added material that she has worked on, either collected by herself or given to her by others for identification. Besides the original gift, others were made in February 1966, November 1968, December 1972, April 1974, and May 1974. These include valuable overseas exsiccatae that Mr R. M. Laing had given to Dr Flint in 1935, 10 collections made by Mr Colin Meurk, of freshwater and soil algae from Campbell Island and 35 collections made by Mr Hugh Wilson of freshwater and terrestrial algae from Mount Cook National Park. Dr Flint has also deposited 10 collections, including the types, of the new genus and species *Parallela novae-zelandiae* Flint.

Bryophytes (Miss B. H. Macmillan)

Work has continued on packeting and incorporating collections made in Fiordland by V. D. Zotov on the New Zealand–American Fiordland Expedition 1949, and by H. H. Allan on the New Golden Hind Expedition 1946. These were identified by Mrs E. A. Hodgson and Mr G. O. K. Sainsbury. Collections donated by Dr D. S. Horning from Three Kings Islands and southern islands have provided sets of duplicates for exchange.

Alpine species are much better represented with the addition of the Mount Cook National Park material. Recent collections from Nelson beech forest and Canterbury mountains are being incorporated.

We are grateful to Dr A. T. Dobson of University of Canterbury for identifying the large collections of *Sphagnum* made by R. Mason and N. T. Moar during swamp surveys, enabling these to be incorporated. Dr Dobson and Dr J. Child have kindly donated specimens representing new records for New Zealand of *Drepanocladus, Sphagnum* and *Rhytidiadelphus.*

We are indebted to Mr K. W. Allison of Dunedin for assistance with identification of both mosses and liverworts. In 1975 Mr Allison gave to the Botany Division his herbarium of 10,000 collections of mosses and 8,000 collections of liverworts. These he had placed in uniform

packets provided by the Division and had brought the nomenclature up to date so that they were ready to be incorporated into our files. The regions most strongly represented are Waipoua Forest, Rotorua and Dunedin.

THE LIBRARY

(Mrs M. E. Blackmore)

We are continuing to build up a comprehensive collection of world floras. New additions include the floras of Sydney region, Sénégal, Réunion, Brazil, Rumania, Patagonia, Portuguese Guinea, Madagascar, Ecuador, Thailand, West Pakistan, Canary Islands, Scilly Isles, Galápagos Islands, and the mountains of Java.

Many books and monographs on algae, particularly marine were added to our small but important holdings.

We are indebted to Mrs Oliver for making available many boxes of bibliographic material, reprints and clippings of botanical interest, collected by the late Dr W. R. B. Oliver.

The following is a selection of early literature added to the library:

Bentham, G. Labiatarum genera et species. 1832-36. Microfiche.

Candolle, A. de. Collection de mémoires pour servir à l'histoire du règne végétal. 1988-1838. Reprint 1971.

Forster, J. G. A. A voyage round the world. Bearb. von Robert L. Kuhn. 1968. Originally published 1777.

Kunth, C. S., Revision des Graminées publiées dans les nova genera et species plantarum de Humboldt et Bonpland, précédée d'un travail général sur la famille des Graminées, par Charles Sigismund Kunth. 1829-34. Microfiche.

Link, H. F. Hortus Regius Botanicus Berolinensis. 1827-33. Microfiche.

Montagne, J. F. Sylloge Generum Specierumque Cryptogamarum. 1856. Microfiche.

Nägeli, Carl. Die neuern Algensysteme und Versuch zur Begründung eines eigenen Systems der Algen und Florideen. 1847. Reprint 1970

Trinius, C. B. Species Graminum. 1828-36. Reprint 1970.

United States Exploring Expedition, 1838-1842. Reprint 1971. Botany 1-3 and Atlas.

Von Haast, J. Geology of the Provinces of Canterbury and Westland, New Zealand. 1879.

Weddell, H. A. Chloris Andina. 1855-57. Facsimile 1971.

We are extremely grateful for the following donations:

Presented by Mr Cameron Hay.
8th International Seaweed Symposium August 1974. Programme and abstracts.

Presented by Kungl. Vetenskapsakademiens, Stockholm.
Arkiv för Botanik. Ser. 1, Volumes 1-15.

Presented by Professor Heinrich Walter.
Walter, Heinrich. Vegetation of the earth, in relation to climate and the eco-physiological conditions.

Presented by Dr G. W. Butler.
Yen, D. E. The Sweet Potato and Oceania: an essay in ethnobotany.

Presented by the Working Committee of the 6th World Orchid Conference, Sydney.
Proceedings of the 6th World Orchid Conference. 1971.

Presented by Dr M. H. Aitken.
Collection of colour transparencies of native plants.

Presented by Mr David Macmillan.
Early numbers of The City Beautiful.

Presented by Professor C. G. G. J. van Steenis.
Backer, C. A. Atlas of 200 weeds of sugar cane fields in Java.

Presented by Dr O. Degener.
Degener, Otto. Naturalist's South Pacific Expedition: Fiji. 1949.

Presented by Dr J. Ewan, on behalf of Mrs Harry T. Howard Jr.
T. H. Huxley's Diary of the voyage of H.M.S. Rattlesnake.

Presented by Professor Carlos Muñoz Pizarro.
Muñoz Pizarro, Carlos. Chile: plantas en extinciôn.

Presented by The Herbarium Library, Botany Department, Cairo University.
Täckholm, Vivi. Students' flora of Egypt. 2nd ed. 1974.

Presented by Dr A. F. Mark.
Mark, A. F. A vegetation survey of Mount Aspiring National Park, 1972.

THE EXPERIMENTAL GARDENS

1. Lincoln headquarters, South Island (Officer-in-Charge, Mr I. C. Brown).

The Experimental Gardens consist of 2.0 ha in Headquarters Block and 7.25 ha in East Block. Headquarters Block is divided into 16

1,000 m^2 plots. Here a new 15.24 cm (6 inch) well with a submersible pump for irrigation has been installed. In East Block a bridge over a normally dry gully has recently been completed.

Propagation facilities include two 5.5 × 9.0 m glasshouses attached to a potting shed, four smaller isolation glasshouses, three 5.5 × 9.0 m lath shadehouses with PVC roofing, three cold frames and a water trough for pots of wet-land plants. In one of the larger glasshouses is an electronic leaf controlled misting system. Supplementary lighting is also available in two of the glasshouses. In the potting shed is an office records room with a fire-proofed cabinet for garden accession sheets; a steam sterilising pit serviced by a mobile boiler is also housed in this building.

Field plantings in Headquarters Block include indigenous species of *Festuca, Poa, Chionochloa, Sophora, Aristotelia, Fuchsia,* and *Hebe.* Extensive *Cortaderia* plantings include both indigenous and introduced species and hybrids, and there are also collections of adventive species of *Aster, Bromus* and *Salix.* Plants grown in pots for scientific purposes include species of *Astelia, Collospermum, Libertia, Hebe, Mentha, Uncinia, Carex, Claytonia, Celmisia, Epilobium, Fuchsia, Podocarpus, Clematis* and native orchids and grasses. There is also a collection of introduced aquarium plants to check identifications, and a small collection of plants from the Cook Islands. There has been a marked increase in accessions of indigenous ferns, and work has been carried out on methods of propagating ferns from spores.

In a joint project between Botany Division and the Noxious Weeds Inspectors of the 13 Canterbury County Councils, a live collection of 60 odd weeds listed in the Noxious Weeds Act, 1950, is maintained in the Gardens, growing in 30 × 30 cm wooden plant tubs. These plants are used by Inspectors for exhibits at agricultural shows, field days etc. and by officers of the Division for weed identification talks to agricultural advisory officers, horticulturists and other interested groups. With new noxious weed legislation pending, a change in the species composition of the collection is likely in the near future. On East Block area the main project is 2 ha of *Cortaderia* spp. as well as *Hebe* cultivars, *Rosa rubiginosa, Phormium* spp., and *Coprosma* hybrids. Ministry of Agriculture and Fisheries and Entomology Division substation (DSIR) also have field trial plots in this area. The remaining land is in grass and is kept mown. Since the arrival of poplar rust last season the poplar shelter belts round East Block boundary have been interplanted with willows. Eventually the poplars may have to be removed.

2. Taita Substation, Soil Bureau, Lower Hutt, North Island (Officer-in-Charge, Mr A. P. Druce).

In addition to some 270 species of indigenous higher plants growing naturally at Taita, a further 550, either planted out or in pots, are available for study or reference.

TAXONOMY

(Mr H. E. Connor)

Taxonomic botany should reflect the refining of our knowledge and at the same time the expansion of our understanding of the plants in this country. The flora in New Zealand increases in number constantly; new importations for horticulture, agriculture and soil conservation and the unsolicited entry of new weedy species from abroad being the most regular ways.

The history of New Zealand botany reveals that there have been "Floras of New Zealand" since 1855 culminating in "Flora of New Zealand" Volume I in 1961 and Volume II in 1970. These two volumes dealt exclusively with native species. There still remains sections of the flora for which there is no recent, complete account, the grasses for example and the naturalised flora. The final draft of Volume III of the "Flora of New Zealand" which will cover the naturalised monocotyledons excluding the grasses, has been completed and should on publication fill one significant gap. The companion volume on naturalised and adventive dicotyledons must now become a priority, because it is abundantly clear that information on weed species is in great demand across the whole country. In the ultimate, Floras must encompass both the native and naturalised groups in the one work, but the intermediate and present phase poses problems in presentation for the best results to be available to users. The proposed treatment described below under "Adventive Monocotyledons" for Volume III is not a compromise, but a best decision for the times. Doubtless there will be amendments arising from experience, and later volumes within the next decade will depart in detail from the outlines given here, but they, too, will be best decisions for the times. Flora writing for New Zealand must remain a developing art.

The publication of a Flora does not necessarily mean that all the entities included in it are fully understood; on the contrary, Volume I of the Flora made it clear that certain native groups were in need of a closer scrutiny. This more detailed examination proceeds at all times, and in the Compositae in particular, where there were many unresolved problems, re-examination has been intensive in such genera as *Senecio* and *Celmisia.*

Emphasis is frequently laid on the point that taxonomic revisions are often constrained by the limits of political boundaries, and that taxa in neighbouring countries, or floristically related areas, may be important, if not more so, for the revision, than are some in the home country. For a genus such as *Celmisia* where Australian elements appear to be the only extra-territorial outliers, the problem is relatively small; for *Senecio,* a cosmopolitan genus, the problem is immense. Both situations have received attention here and are discussed below.

Australian members of the monocotyledonous genus *Luzula* are being revised (see discussions below) and the relationships between New Zealand and Australian species studied. This has revealed that there are no taxa common to the two countries, and hindsight shows that independent revisions would not have been a source of error. The other extreme to the situation in *Celmisia* is where New Zealand botanists must attempt nomenclatural and taxonomic revisions of genera better represented elsewhere. An example is *Cortaderia* (*Taxon 23:* 595, 1974) where there are only four closely related species in New Zealand, with about 20 species in South America, spread among several sections of the genus. Thus the directions taken in taxonomic research may be as diverse as are the needs for the country or for the research in hand.

New Zealand lichens have interested lichenologists all over the world, and now for the first time we can report that this group has the individual attention of one member of the staff. Liverworts and mosses, like the lichens, were studied in this country by research workers of amateur status but of high professional repute. This era is now over and the responsibility lies with Botany Division to continue these studies; staff for taxonomic and ecological work on mosses and hepatics becomes imperative.

Monocotyledons

1. Flora of New Zealand. Adventive Monocotyledons (Mr A. J. Healy and Dr E. Edgar).

A final draft of the text for the volume of adventive monocotyledons (except grasses) has been completed and will cover about 76 genera and 180 species. The principal function of this volume will be to provide an identification manual, since there is little need to discuss problems of taxonomy and nomenclature as in the volumes dealing with the indigenous flora. The main task has been to make sure that the adventives have been correctly identified with their foreign counterparts and that currently acceptable names are used. Because the emphasis will be on identification it seemed necessary that the keys in this volume should cover *indigenous* as well as adventive species. There are seven genera, *Potamogeton, Rhopalostylis, Juncus, Luzula, Cyperus, Scirpus* and *Carex*, in which both native and adventive species occur. In the largest genera *Juncus* (29 adventive, 16 native species) and *Carex* (21 adventive, 73 native species) there are no features which immediately distinguish all adventive species from all native ones, and consequently, for these two genera a key to both adventive and native species is absolutely essential. This pattern has been followed through the volume where appropriate. For instance, the families Liliaceae, Agavaceae, and Iridaceae are represented by both native and adventive *genera* though no one genus is represented by both native and adventive species. A combined key to adventive and native *genera* has been made for each of these three families, similarly a key to *all monocoty-*

ledon families growing wild in New Zealand, both native and adventive has been prepared.

Of the 180 adventive species included in the text about half are garden escapes. Two of these, *Homeria collina* (Cape tulip) and *Watsonia bulbillifera* have been declared noxious weeds, while *Hedychium gardnerianum* (wild ginger) and *Gladiolus cuspidatus* are aggressive weeds in the Auckland district. Others such as *Crocosmia crocosmiflora* (montbretia), *Lilium tigrinum* (tiger lily) and *Schizostylis coccinea* (Kaffir lily) have become sufficiently widespread to warrant entry in the recently published 'Standard Common Names for Weeds in New Zealand". However, some escapes such as species of *Narcissus*, do not spread very much although they can persist for a very long time in one place. It is considered that anything growing "outside a fenced area" is adventive and has been given equal treatment in the Flora with the more widespread or effectively naturalised species.

2. Australian *Luzula* (Dr E. Edgar).

Nordenskiöld's revision of Australian *Luzula* (*Botaniska Notiser 122:* 69, 1969) led to an upsurge of collecting in the genus which in turn has brought to light new taxa. An account of *Luzula* from the flora of New South Wales is now being prepared, but before this can be published a preliminary paper has had to be written in which the new taxa will be described (two new species, one alpine, one from the New South Wales Tablelands, a dwarf Kosciusko subspecies of *L. acutifolia* and a Kosciusko subspecies of *L. oldfieldii*). It is also considered that Nordenskiöld's varieties of *L. meridionalis* are sufficiently distinct to merit specific rank.

At the same time it has now been possible to identify with certainty New Zealand specimens of *Luzula* collected in Marlborough which Edgar (*N.Z. Journal of Botany 4:* 182, 1966) suggested were introduced from Australia. A third entity, collected from the Volcanic Plateau and at Hoopers Inlet, Otago Peninsula was suspected (Edgar loc. cit.) to be introduced because unlike other indigenous luzulas, its seeds had long caruncles (fleshy outgrowths at the base). These plants can still not be matched with any overseas *Luzula* and will be described as a species new to New Zealand.

A comparative study of the characters distinguishing Australian and New Zealand species of *Luzula* has been made (*N.Z. Journal of Botany 13:* 781, 1975). The species of each country form a separate group except that New Zealand *L. picta* and *L. banksiana* and the new species from the Volcanic Plateau fall within the Australian rather than the New Zealand group of *Luzula*.

I am grateful to Australian herbaria at Sydney, Canberra, Melbourne and Adelaide for making their *Luzula* collections available for study and I am especially indebted to Mr Max Gray of CSIRO, Canberra for much valuable information and to Dr L. A. S. Johnson and Dr B.

Briggs of the Royal Botanic Gardens, Sydney with whom I spent two weeks in the field in New South Wales and Victoria in October 1971.

3. *Cortaderia* (Mr H. E. Connor and Dr E. Edgar).

During a study of the breeding systems in this genus (*Evolution 27:* 663, 1974) it became clear that there were some unresolved taxonomic problems in this predominantly South American genus. We have reviewed the genus as a whole (*Taxon 23:* 595, 1974), making few, but quite essential, changes in the status of the many taxa. The more important nomenclatural changes involved the recognition of *C. jubata* as the valid name for plants usually regarded as *"C. quila"*, and the transfer to *Cortaderia* of *Danthonia archboldii* from New Guinea.

Plants with violet coloured panicles are widespread as a weed in Auckland and Northland and were referred to as *C. atacamensis* (*N.Z. Journal of Botany 3:* 17, 1965) but these should now be treated as *C. jubata* (Lem.) Stapf.

4. *Chionochloa* (Mr H. E. Connor and Mr A. W. Purdie).

Triterpene methyl ethers are compounds that have been found predominantly in the grasses, but nowhere have all the species in one genus been studied. For *Chionochloa* with 20 species in New Zealand and one in Australia, extensive collecting and analysis of epicuticular leaf wax for these triterpenoids has been completed. As we reported earlier (Triennial Report for 1969-71) some species lack these compounds — 8 species in all — and others synthesize them. Six triterpene methyl ethers have been isolated; two are new tetracyclic sterols, the other four are pentacyclic and are relatively well-known though some of them have been isolated only rarely from plants.

Chionochloa as a whole does not fall into readily recognizable groups of species with particular triterpene methyl ether complements, but rather shows two kinds of pattern. In some few species "species specific" triterpene methyl ethers occur such as the arundoin and lupeol methyl ether mixture in *C. cheesemanii*; other species such as *C. pallens* comprise distinct triterpene methyl ether races with regional geographic distributions. In one or two species an otherwise regular triterpene methyl ether pattern is broken by the presence in perhaps one population only of triterpenoid (s) different from usual. Some general conclusions are (1) triterpene methyl ethers have proved useful in the recognition of chemical races in some widespread species (2) some widespread species do not synthesize these compounds (3) taxonomic verification can be assisted in some species by using these compounds as characters.

Dicotyledons

1. *Celmisia* (Compositae) (Dr D. R. Given).

Much of the basic work for a monographic treatment of the genus has been completed. Several groups of species which have proved

particularly intractable require further study. These are the *Celmisia gracilenta* complex, the Australian taxa and the species clustered about *Celmisia coriacea*. Maintenance of live collections of most species and their varieties at Lincoln has provided fresh material for morphological study and has allowed comparisons of plants under uniform conditions including records of flowering and fruiting times. Dr J. B. Hair has completed a cytological survey of the genus, obtaining chromosome counts from almost every species including those occurring in Australia.

Two numerical analyses have been carried out on the *Celmisia gracilenta* complex. The first was a treatment of 100 herbarium specimens randomly selected from CHR. Eighteen attributes were scored and the resultant matrix was analysed by the ASSORT program using a flexible strategy in conjunction with centroid sorting. Later, the same data were used to carry out a principal component analysis. To display this, a three-dimensional model has been built and nearest neighbour linkages calculated. Comparison of the two numerical approaches is allowing aggregates of the original specimens to be formed from which definable taxonomic groups may be constructed. The analyses emphasise the continuous nature of variation within the complex. A point of interest is the occurrence of different ploidy levels within it and the correlation of these, in part, with geographical distribution. Phenological studies indicate that flowering time may effectively separate sympatric taxa, and that members of the complex in the North Island flower earlier than those from further south even when grown for several years under the same glasshouse conditions.

The Australian taxa have been delineated on the basis of herbarium and garden study. A collection of live plants (chiefly due to the collecting efforts of Dr Peter H. Raven) has allowed the growth forms and cytology to be examined in great detail. Present work is concentrated on herbarium specimens, chiefly looking at infraspecific variation and geographical distribution of entities which deserve recognition.

The group of species clustered about *Celmisia coriacea* pose both taxonomic and nomenclatural problems. The epithet "coriacea" is almost certainly wrongly applied. Examination of type material at Göttingen and in London shows that the species described by the Foresters is not that commonly accepted today as *C. coriacea*. The application of other specific names in this group is confused and will require careful typification of even long established species such as *Celmisia dubia* and *C. parva*. Taxonomic problems chiefly centre on north-west Nelson where numerous entities occur and, to some extent, intergrade. In particular, the relationships existing among coastal populations between Greymouth and Karamea require study. At present, application of specific and varietal names to these populations

is arbitrary and in no way reflects their probable past history and evolution.

The taxonomic limits of the genus have been examined and the distinctive subantarctic *Celmisia vernicosa* made the type species of a new genus, *Damnamenia* (*N.Z. Journal of Botany 11:* 785, 1973). The name follows the lead of Cassini and de Candolle in giving classical names to *Celmisia* and related genera; named for one of the three eldest Dactyls it has the advantage of not being easily forgotten. Other members of the *Celmisia* group of genera are being examined. Herbarium specimens of *Erigeron pappochroma* have been borrowed so that the position of this aberrant species can be better placed in relation to its relatives in *Olearia, Celmisia* and *Pleurophyllum.*

Notable on a smaller scale has been the rediscovery of *Celmisia thomsonii* on Eyre Peak, immediately north of the only stations for *Celmisia philocremna.* Several little known taxa have been studied in the field including *C. macmahonii, C. morganii* and *C. mackaui.* Encouraging is the great horticultural interest in this genus, particularly in the British Isles. Near Dublin it was incongruous to see *Celmisia coriacea* behaving as a weed in alpine rockeries and apparently just at home there as in its native Southern Alps.

2. *Senecio* (Compositae) (Dr D. G. Drury).

(a) Hybrids among the shrubby Senecioneae.

The cultivation of many of the two dozen New Zealand shrubby Senecioneae, a tribe which includes the endemic *Brachyglottis* and *Traversia,* and representatives of the cosmopolitan genus *Senecio,* has resulted in numerous hybrids. The diagnostic anatomical features discovered in a study of nodes and leaf structure of these shrubs (see Triennial Report for 1969-71 , together with palynological, floral and gross morphological characteristics were used to elucidate the parentage of some 20 wild and garden hybrids (*N.Z. Journal of Botany 11:* 731, 1973). Four of these are listed in the current "Flora of New Zealand" under the species names *Senecio lapidosus, S. matthewsii, S. remotifolius* and *S. spedenii.* Four hybrids appear to involve *Senecio* shrubs and scapigerous rosette herbs of the *Senecio bellidioides* alliance as parents, and another pair prove to be inter-generic hybrids between *Brachyglottis* and *Senecio elaeagnifolius,* and *S. greyi.* A vegetative key, and a general key incorporating features from the whole plant body is now available for these Senecioneae and their wild and garden hybrids. In the keys two new taxa, *Senecio pentacopus* and *Brachyglottis repanda* var. *fragrans,* and a new combination *Senecio myrianthos* are also catered for.

(b) Affinities of *Senecio kirkii.*

While investigating the possible affinities of the New Zealand shrubby Senecioneae with other representatives of that tribe, a remarkable likeness was noticed between *Senecio hectori* and illustrations of *Lachanodes prenanthiflora* and *Pladaroxylon*

leucadendron endemics to St Helena Island. On examining preserved specimens of the two species from the South Atlantic, it became apparent that the relationship was not as close to *Senecio hectori* as at first suspected, but more to the singular *Senecio kirkii*, a forest species restricted to North Island, New Zealand. The mutual relationships of the three similar shrubs together with another peculiar forest species, *Senecio insularis* from Lord Howe Island, was assessed using 39 morpho-anatomical features of flowers, involucral bracts and leaves (*N.Z. Journal of Botany 13:* 769, 1975). *Senecio kirkii* is shown to be about the same phenetic distance from *S. insularis* (48% mismatches) as it is from *L. prenanthiflora* (47%), which in turn is about the same distance from *P. leucadendron* (49%). The greatest phenetic distances involved are those between *P. leucadendron* and *S. insularis* (66%) and *S. kirkii* (69%). Several floral traits anomalous in *Senecio* are concurrent in these species, and three of them exhibit almost identical petiole and leaf blade anatomy.

(c) Erechtitoid *Senecio.*

Erechtitoid Senecios, also known as fireweeds because some of them are first to appear on burnt-over areas, are often referred to Botany Division for naming. Although it is usually possible for the specialist to discriminate between the species, identification is made difficult for the tyro in many of the auriculate species with divided foliage by the enormous diversity in leaf outline in any one plant as well as between plants. The problem is alleviated for the most part by differentiating between basal, middle and upper stem leaves when referring to the foliage. An up-to-date key to 12 species of erechtitoid Senecios in New Zealand intercalated with taxonomic annotations, summary of range and ecological preferences of each species is now available (*N.Z. Journal of Botany 12:* 513, 1974). *Senecio bipinnatisectus, S. hispidulus, S. apargiaefolius* and *S. diaschides* are thought to be adventive here; and *S. wairauensis, S. quadridentatus, S. dunedinensis, S. kermadecensis, S. biserratus, S. minimus, S. glomeratus* and *S. scaberulus* are native. *Senecio apargiaefolius* and *S. diaschides* are reported in New Zealand for the first time.

In a modest crossing programme three F_1 hybrids were successfully grown to flowering:

Senecio diaschides ♀ *X hispidulus* ♂, *S. hispidulus* ♀ *X scaberulus* ♂ *and S. bipinnatisectus* ♀ *X hispidulus* ♂.

(d) *Senecio lautus* and allies.

The genetical relationship of this New Zealand coastal *Senecio* with the common European groundsel was established by a crossing experiment. Achenes of the F_1 hybrid *Senecio vulgaris* ♀ *X lautus* 'Oaro' ($2n = 40$)♂ were germinated at 25°C on germination pads. When the yellow-green cotyledons were fully expanded, seedlings were transplanted to pots where they remained until the plants

flowered. The hybrid (2n = 40) has up to 10 bivalents at meiosis (chromosome studies made by Mr E. J. Beuzenberg), and is seed sterile.

Other successful crosses in this alliance are *Senecio lautus* 'Dan Rogers Creek' (2n = 80) *X lautus* 'Norfolk Island' (2n = 80)—seed sterile, and *Senecio glaucophyllus* (2n = 100) ♀ *X lautus* 'Norfolk Island' (2n = 80)♂—with mainly 40 bivalents and 10 univalents at meiosis, and sterile.

3. *Lagenifera-Lagenophora* (Compositae) (Dr D. G. Drury).

Opinions vary as to whether the three daisy-like species of *Solenogyne* (one adventive to New Zealand) are worth distinguishing generically from *Lagenifera* a genus of 15 species of which 5 are native. In a paper devoted to the largely Australian problem of *Solenogyne-Lagenifera* Section *Lagenifera* taxonomy (*N.Z. Journal of Botany 12:* 365, 1974), it is reasoned from comparative observations on growth-habit, leaf indumentum, stomatal frequency, achene glandulosity and involucral bract anatomy that *Solenogyne* is best retained in *Lagenifera* as one of three infra-generic groupings *Lagenifera, Microcalia,* and *Solenogyne* (*including Emphysopus*). Uncertainty still surrounds the name *Ixauchenus.* The sympodial Lagenifera group is represented in New Zealand by *L. stipitata* (formerly *L. pinnatifida* var. *tenuifolia*), *L. montana, L. pinnatifida*; the sympodial *Microcalia* group by *L. strangulata, L. petiolata, L. cuneata, L. barkeri* and *L. pumila*; and the monopodial *Solenogyne* group by *L. gunnii, L. mikadoi* and *L. lanata. Lagenifera montana* and *L. mikadoi* are new records for New Zealand.

4. *Coprosma, Crassula, Oreomyrrhis* (Mr A. P. Druce).

Work has continued on the study of the species of *Coprosma* (Rubiaceae), *Crassula* (Crassulaceae, Section Tillaeoideae) and *Oreomyrrhis* (Umbelliferae). Fifty-three species of *Coprosma* are recognised in the New Zealand region, nine of them unnamed. All but one of the species have been brought together under cultivation at Taita Substation and Mr Q. Christie of Soil Bureau is at present photographing their stipules. With perhaps one exception the details of the stipule are diagnostic for each species. Thirteen species of *Crassula* are known in New Zealand. Work is complete on this genus, and is being prepared for publication. Beyond the finding of another species no further work has been done on *Oreomyrrhis.*

5. *Rhododendron* (Mrs M. N. Philipson).

The rhododendron herbarium has continued to grow, with additions both of horticultural material and of specimens from New Guinea. The horticultural material includes a large consignment of species in cultivation at the Royal Botanic Garden, Edinburgh, while the wild collections are periodically added to by the Department of Forests at Lae, New Guinea, which continues to send duplicates of new collections as they come to hand.

Identifications of rhododendrons submitted by Pukeiti Rhododendron Trust and from horticulturalists have been made.

The revision of *Rhododendron* section *Lapponicum* which was completed during time overseas has been written up (*Notes from the Royal Botanic Garden Edinburgh 34:* 1, 1975). In this work 26 species are recognised while 25 are relegated to synonomy for the first time and 3 to varietal status. *R. setosum* is excluded from section *Lapponicum* and a new section, *Setosum,* is described to include it. During thec ourse of the revision an undescribed species, which does not conform to any of the 45 known sections of the genus, was recognised and described (*Notes from the Royal Botanic Garden Edinburgh 33:* 493, 1975).

6. *Carmichaelia* (Mr H. E. Connor, Mr A. W. Purdie).

Carmichaelia is an indigenous genus in the Papilionaceae with an estimated 40 species. It has proved so taxonomically confusing that some reassessment is needed.

Studies of seed proteins in various genera have proved useful in indicating species boundaries and interspecific relationships. We have begun a programme using gel-electrophoresis methods as the first experimental approach in this genus.

Ferns

(Dr D. R. Given)

During the last five years there has been a resurgence of interest in New Zealand fern taxonomy. Revisions of genera have been undertaken by both New Zealand and overseas workers. There is also an increased interest in some of the more difficult fern families such as Thelypteridaceae and Cyatheaceae and world-wide revisions are currently being undertaken overseas. These revisions often result in large scale changes in nomenclature. For example, Holttum's work on the Thelypteridaceae has shown that only one of the five species formerly assigned to *Thelypteris* should remain in that genus. The other four are each placed in a separate genus and even the one species which is being retained requires a different specific epithet. It is becoming increasingly evident that New Zealand has a waif and stray fern flora largely composed of oddments related to either Australian, circumpolar or tropical groups.

In view of these developments it has become essential that close scrutiny be made of the names applied to New Zealand ferns. Some endemic taxa are known to be closely related to overseas ones and for numerous species, names have been adopted which are based on overseas types. A collection of type descriptions and photographs of types is being built up to facilitate nomenclatural studies which will help stabilise New Zealand fern names. During early 1974 several

hundred type specimens were examined and photographed in British and European herbaria. These have been sorted and indexed. They include many of the taxa described from New Zealand material by William Colenso, the Hookers, Allan Cunningham and the Forsters. In addition, exchanges have been fostered with overseas herbaria to ensure adequate representation of non-New Zealand ferns and fern allies in our herbarium. The exchanges also assist taxonomists in other countries by providing good, recently collected specimens of New Zealand taxa.

Live collections have been established, partly to provide a source of material for exchange but also to allow studies of living plants. Currently, over 40 species are in cultivation and emphasis is being placed on those presenting taxonomic problems, endemics of particular interest such as *Leptopteris superba, Anarthropteris lanceolata* and *Cardiomanes reniforme,* and species which are rare and local in distribution such as *Anogramma leptophylla.* Trial spore germinations have yielded gametophytes and subsequent sporophytes; these will be followed by a modest programme of hybridisation studies. Growing of ferns through gametophyte and young sporophyte stages of the life cycle will allow description of some little known morphological features such as the trichomes on the first fronds of the sporophyte.

Taxonomic work is proceeding on *Pleurosorus* (*N.Z. Journal of Botany 10:* 495, 1972) although it has not yet been possible to obtain spore germination and so gametophytes have yet to be examined. In Switzerland living material was seen (by courtesy of Professor Th. Reichstein, Basel) and herbarium specimens of all three species were examined in several herbaria. It is hoped that the species can be grown under uniform conditions at Lincoln and that a hybridisation programme will be undertaken. European work has shown that *P. hispanicus* (Spain and Morocco) is similar to at least one species of *Asplenium* found in the same region, but for the other species, *P. papaverifolius* (Chile and Argentina) and *P. rutifolius* (Australasia), no obvious relatives have been found.

Studies of *Grammitis* are shortly to be published in collaboration with Mrs Barbara Croxall of Edinburgh, as an initial paper dealing with a revision of the New Zealand species. Further studies are envisaged on variation within species, particularly *G. armstrongii.* Live collections are being maintained to allow cytological examination, but *Grammitis* is proving a difficult genus to establish under artificial conditions.

Other projects include a survey of the Pteridophyta of Banks Peninsula which is nearing completion, cultivation of members of *Blechnum procerum* complex to determine growth-forms and the relative effects of genetic and environmental variation, and morphological examination of *Ophioglossum* and *Cyathea* species from New Zealand to allow a clearer delineation of our taxa. The Banks

Peninsula work has indicated that pteridophytes are promising indicators of environmental change, some species being particularly sensitive to alterations in habitat brought about through man and his agencies.

Lichens

(Dr D. J. Galloway)

A modern treatment of the taxonomy and ecology of the very diverse lichen flora of New Zealand is being attempted and the first stage of this project, namely a book of keys to the 50 major macrolichen genera, is being prepared in collaboration with Mr P. W. James of the British Museum (Natural History). The work is being done on study leave at the Natural History Museum in London and is expected to be concluded some time in 1977.

Dichotomous keys, utilising morphological data able to be determined by a x 10 lens, and chemical data derived from thin-layer chromatographic analysis of acetone-soluble lichen extracts (where applicable) have been prepared for the following genera: *Anzia, Anaptychia, Argopsis, Baeomyces, Cladia, Collema* (Dr Gunnar Degelius, Gothenburg), *Dendriscocaulon, Erioderma, Lichina, Menegazzia* (Mr P. W. James), *Neuropogon, Normandia, Parmelia* (subgenus *Melanoparmelia* has been revised by Dr T. Esslinger, Duke University), *Polychidium, Psoroma* (Mr P. W. James), *Siphula, Sphaerophorus* (Dr K. Ohlsson, East Lansing), *Solorina, Steinera* (Mr P. W. James), *Stereocaulon, Teloschistes, Thysanothecium, Xanthoria.* Keys to the remaining genera are in preparation viz: *Alectoria, Cetraria, Cladonia, Coccocarpia, Coenogonium, Cornicularia, Dermatocarpon, Ephebe, Heppia, Leptogium, Lobaria, Massalongia, Nephroma, Pannaria, Parmeliella, Physma, Peltigera, Placopsis, Pseudocyphellaria, Physcia, Physciopsis, Ramalina, Sagenidium, Sticta, Thelidea, Toninia, Usnea, Umbilicaria.*

A number of the larger, floristically important lichen genera are being studied for publications dealing with problems of taxonomy, ecology and plant geography. The lichen genus *Parmelia* is almost completed and discusses some 57 species. *Stereocaulon* and *Siphula* are also under review.

A bibliography of literature relating to New Zealand lichens has been published (*N.Z. Journal of Botany 12:* 397, 1974). Type specimens from major British, European and American herbaria have been used to supplement the rather sparse data on lichens available to students of lichenology in New Zealand. Archival material relating to early collectors and their collections is also being accumulated.

Seaweeds

(Dr M. J. Parsons)

An algal binomial card index is being prepared and will include all names ever used for New Zealand seaweeds. This will be a basis for future taxonomic studies on the marine algae of the New Zealand botanical region. The index will include references to the original description and illustrations, type locality, original specimens or types used for the description, and herbaria in which specimens are housed. Further references both historical and recent which mention the taxon in any way will be included as these come to hand. Assembling this information in one index from the many sources available, will enable in due course an accurate synonomy for each species to be established.

Initially the taxonomic and morphological work will concentrate on the Rhodophyceae, the red seaweeds. The genera *Dasya* and *Heterosiphonia* (Dasyaceae), *Bostrychia* and *Brongniartella* (Rhodomelaceae) and *Gigartina* (Gigartinaceae) are being studied at the present time.

During the last few years world demands for seaweed polysaccharide gums and mucilages have increased tremendously. As part of an evaluation of the natural resources of New Zealand, studies are being carried out on seaweeds that would possibly produce these gums and mucilages. Two of the most important seaweed polysaccarides are agar and carrageenan both extracted from red seaweeds. Agar, from *Pterocladia* species, has been manufactured in New Zealand since World War II and small amounts of carrageenan seaweeds, *Gigartina* species, have been used in the brewing and the milk custard-making industries. New Zealand has some 20 species of *Gigartina* from which carrageenan could probably be extracted, and there appears to be a potential for an industry here.

To date some 300 collections of *Gigartina* have been prepared for standard carrageenan analysis, carried out by Mr S. E. Pickmere of Applied Biochemistry Division, DSIR, Palmerston North. Voucher specimens of all these collections are retained at CHR.

As the gametophyte or sexual plants of one species are often morphologically different from the tetrasporophyte or asexual plants of the same species, these two stages of the life cycle were collected and analysed separately. The first results (*Phytochemistry 12:* 2441, 1973) showed that the gametophyte plants contain high kappa and low lambda carrageenan and the tetrasporophytes of the same species contain low kappa and high lambda carrageenan. This phenomenon has also been reported from *Chondrus crispus,* the main source of carrageenan, for species of *Iridaea* and other species of *Gigartina.*

Following this initial investigation, a 14-month survey was undertaken of a population containing three species of *Gigartina* occurring in a small area on the rocky platform of Oaro, 20 km

south of Kaikoura, on the east coast of the South Island. The results from this survey confirm the previous ratios of kappa to lambda carrageenan and show that the carrageenan content does not vary significantly during the year with either season or the age of the plant (*N.Z. Journal of Science 18:* 585, 1975). Collections of five species have shown no marked variation in total carrageenan, kappa or lambda carrageenan content when samples were obtained from two or three ecologically similar localities 3-6 degrees of latitude apart.

From early analyses it was evident that there is a difference in carrageenan content between some species of *Gigartina.* Twelve species of *Gigartina* have been analysed so far and only kappa and the related mu carrageenan of the gametophytes show sufficient variation to be of taxonomic value.

POISONOUS PLANTS

(Mr H. E. Connor)

"The Poisonous Plants in New Zealand" was first published in 1951 as Bulletin No. 99 of New Zealand Department of Scientific and Industrial Research. That edition is out of print and out of date, and the text for the second and revised edition is now in press.

Plant poisoning of livestock continues as a problem for farmers, though nationally losses are not significant compared with livestock losses from other causes. Those plants that were historically important in animal poisoning are still important today e.g. tutu, ragwort, ngaio, bracken and yew; species of *Cestrum* have become widespread as weeds, and stock losses from them have become more numerous.

Nitrate accumulates to higher than normal levels in some plant species under certain conditions with a consequent risk of methaemoglobinaemia in animals that graze these plants. The frequency of this type of poisoning, which results from ruminal reduction of nitrates to toxic nitrites, seems to be increasing in this country.

This second edition will include discussion on fungi poisonous to man and on algal blooms that are toxic to livestock; neither was discussed in the first edition.

PACIFIC ISLANDS

(Mr W. R. Sykes)

1. Cook Islands.

In the Triennial Report for 1969-71 mention was made of the Cook Islands plant collection resulting from the 1969 Cook

Bicentenary Expedition. Most of the specimens were collected on Rarotonga by Professor W. R. Philipson of the University of Canterbury. Apart from this island, there has been extremely little botanical work in the Group. The opportunity to rectify this came with simultaneous invitations to me to join Soil Bureau, DSIR's 1974 expedition to the Southern Cooks and the Cook Island Museum Society's expedition to Palmerston Atoll. The latter celebrated Captain Cook's discovery of the Atoll, and it took place within a week of the 200th anniversary of the event. The vegetation is composed of a small number of species which are mostly typical of remote coral atolls in the tropical Pacific.

From Palmerston I visited Aitutaki (including three of its motus), Manuae, Atiu, Mauke, Mangaia, Takutea and Mitiaro, in that order. All but one of these islands are north to north-east of Rarotonga and range from the floristically poor Manuae atoll to an island such as Atiu where there is a well developed makatea (raised coral) flora and an island volcanic area with remnants of indigenous vegetation. Aitutaki is dominated by adventive and cultivated plants on both coral and volcanic soils. Mitiaro is smaller but has communities and species which are not, or very rarely, found elsewhere in the Cooks. South-east of Rarotonga lies Mangaia, the second largest island in the Group. The makatea is the most extensive and difficult to cross in the region, and in addition there is a large area of mainly very modified volcanic terrain in the interior. Elements of a more temperate flora amongst both indigenous and naturalised plants are more obvious than elsewhere in the Cooks, excluding the higher parts of Rarotonga.

2. Kermadec Islands.

The conservation of these isolated volcanic subtropical islands is now the concern of four Government departments. Since the final extermination of feral goats on Macauley in 1970, efforts have been directed towards doing the same on the main island, Raoul. Simultaneously practical measures against several noxious weeds have been initiated. The most important species is *Caesalpinia decapetala* (Mysore thorn) now covering many acres in Denham Bay, Raoul. In an aerial survey in September 1974 I made an assessment of the extent of this weed and a trial aerial application of Tordon 2G granules followed. Previously a small patch had been hand-treated from the ground with considerable success.

3. American Samoa.

In September 1974 a visit was made to Tutuila Island. With the assistance of the Agriculture Department in Pago Pago, plantations, villages and Taputimu Experimental Farm were visited. The opportunity was taken to amass as large a collection of weeds as possible. They will supplement Botany Division's already considerable Western Samoan collection and help to increase our knowledge of

the vegetation of the tropical South Pacific. This is essential in view of the increasing DSIR involvement with assistance in the development of the largely agricultural economies of the Islands.

4. Tonga.

Botany Division has hitherto had virtually no contact with the nearest tropical islands to New Zealand. However, at present the Soil Bureau, DSIR is planning to map soils on the most important islands of the Kingdom of Tonga, and with current proposals to create National Parks on one or more of the floristically more interesting ones, there is likely to be more interest shown in the vegetation of the Group. Eua is one of the first islands being investigated by Soil Bureau and a small collection of some of its commonest plants was made by Mr D. W. Ives for Botany Division in 1974.

ECOLOGY AND CONSERVATION

(Dr P. Wardle)

Ecological studies have been a major activity at Botany Division for many years; and to an increasing extent, they have been directed towards adequate conservation of New Zealand's flora and vegetation. This trend was firmly established in the early 1960s, when the Division proposed vegetation surveys of the National Parks to the Department of Lands and Survey. A further commitment was entered into in 1971, when Mr and Mrs Kelly, working from a caravan equipped for survey work and including living quarters began the biological survey of scenic and allied reserves administered by the same department.

The deep concern with environmental matters that has arisen in the developed nations during the last decade has, in New Zealand, focused on two specific developments, these being the harnessing of Lakes Manapouri and Te Anau in Southland for generation of electricity, and the proposal for large scale utilisation of beech forests in North Westland-Nelson and in Southland. To meet demands for information about ecological consequences of these developments, three new staff members have been appointed, one based at Dunedin and two at Nelson.

Another botanist was appointed to Dunedin to work on botanical implications of the proposed Clutha Valley hydro-electric scheme, which is as massive as the Southland scheme, but which has not aroused as much public controversy. The shorelines of Lakes Manapouri and Te Anau are forested, and most New Zealanders feel strongly about threats to our remaining forested landscapes. Botany

Division considers that it is important to emphasise the scientific interest and conservation value of other native lowland vegetation —such as the semi-arid plant communities that are threatened by the spread of irrigation farming in Central Otago—and to recommend suitable reserves. Some progress has been made in this field, especially in Canterbury where reserves of Plains vegetation at Bankside and Eyrewell have been made following Botany Division recommendations.

Public and government concern about the effects of development on the environment has involved the Division's ecologists in a great deal of extra work, much of which, especially that arising from the requirements of environmental impact reporting, is of an ad hoc nature. With the recent staff increases requests for vegetation surveys are being fairly well met for some districts, and other gaps should be filled in the near future. However, increased capacity is leading to other problems. One is that scientists are being diverted from carrying out basic research in their fields of special competence. While some basic research in ecology is being done, far more is necessary for an understanding of our vegetation and its conservation; Botany Division must not become a purely servicing organisation. Another problem is that the need to survey and to report on numerous relatively small areas is delaying completion of the survey of National Parks, which is our first assignment in the conservation field. This is a matter for concern, even though much botanical information and advice has been given to the Parks, and several members of the staff serve on Park Boards and National Park scientific advisory panels.

The third problem is how to deal with the 'information explosion" that results from having 11 scientists engaged primarily on ecological work, with more appointments pending. While individual approaches to the study of vegetation have served adequately in the past, it is clearly time to consider the need for consistency in methods, and for agreed objectives. During the next triennial period we hope to devise a suitable blue-print for gathering information in the field, storing it in a form where it can be readily retrieved, and using it to develop standardised descriptions and maps of our vegetation and flora.

Vegetation Survey

1. Auckland.

Mr Kelly revisited North Cape in 1974 at the invitation of the Commissioner of Crown Lands, Auckland, and was able to delineate on the ground the "pipeclay" reserve proposed in 1967. This will be a fascinating reserve, with pink-flowered manuka and about 50 characteristic northern shrubland species. The dominant vegetation is *Schoenus brevifolius* sedgeland and manuka shrubland, and interesting species include *Todea barbara, Gleichenia flabellata,*

Drosera pygmaea, Cassytha paniculata, 4 species of *Baumea,* 3 of *Lepidosperma, Tetraria capillaris, Schoenus tendo,* 3 species of *Pomaderris* and North Island fernbird. However management of the area will be complicated by a through road, surrounding farm development and the presence of two species of hakea and the Australian shrubby legume, *Oxylobium.* However, with a total area of about 50 ha, plus boundaries aligned to the topography, it is hoped that it will be big enough to convey the original flavour of the scrublands of Spirits Bay. About two hectares nearby with rich populations of the curious low shrub *Pomaderris phylicifolia* var. *polifolia,* together with *P.p.* var. *ericifolia* and *P. kumeraho,* will be reserved.

During this visit, the only known patch of *Hibiscus diversifolius* at the Cape was revisited, and found to be under threat of extinction by cattle. Previously the desire to keep the location little known had overriden the desire to protect it from animals—but the time has come when some form of fencing is essential if this plant is to persist in the wild in New Zealand. Whether or not the plant is indigenous, or a Polynesian introduction, is immaterial.

The North Cape district is of exceptional biological interest, largely by virtue of its having been an island at times during the Pleistocene. A considerable amount of biological survey work remains to be done, and a way must be found to make this work and resulting recommendations meaningful and acceptable to the local Maori people, for it is all too readily interpreted as an aspect of "pakeha land grab". "Te Karanga a Te Kotuku", published in 1974 by the Maori Organisation of Human Rights, outlines one such viewpoint on the North Cape situation.

Mr Esler is examining metropolitan Auckland for records for the adventive flora, changes in flora since 1872 and surveillance of weeds, and to prepare an account of the early vegetation. The volanic cones have been studied to help develop a policy for turf management on them. He has also studied gumland vegetation and carried out surveys to assist the following organisations:

(a) Hauraki Gulf Maritime Park Board; inner islands (Motukorea, Motutapu, Motuihe, Goat, Tiritiri, Challenger, Kawau), also North Head at Devonport and Whangaruru North Head.

(b) Department of Lands and Survey; islands west of Coromandel Harbour, island reserves and Marsden Cross at Bay of Islands.

(c) Auckland Regional Authority; Waitakere Range and Pakiri coast.

Dr Atkinson in collaboration with Mr Esler, Wildlife Service and Ecology Division, DSIR, has surveyed some of the Hauraki Gulf islands.

Changes in the Waimangu Valley are occurring as a result of erosion, silting and a rise in the level of Lake Rotomahana. Dr

Atkinson has stressed the scenic, historic and scientific interest of Waimangu, and recommended protective measures. He has also reported on the consequences of the rising level of Lake Okataina near Rotorua.

2. Gisborne.

Dr Atkinson sent a report to the N.Z. Forest Service concerning trends resulting from cattle, goats and opossums in the central part of the Ruakumara Range.

3. Taranaki.

Mr Druce prepared a revised check-list of Mt Egmont plants in November 1973, containing the names and distribution of 671 indigenous and 214 adventive plants. The chapter on vegetation is being revised for the third edition of the Egmont National Park Handbook.

4. Wellington.

The Te Porere Redoubt Reserve, between National Park and Turangi, was established by the Historic Places Trust in order to preserve the Redoubt and some of the surrounding landscape in a condition similar to that prevailing at the time of the 1869 battle. Large changes have occurred in the tussock-land since that time. Dr Atkinson has made suggestions about retarding further influx of woody plants and maintaining a tussock landscape in the southern half of the reserve.

A survey of the north-eastern part of the Ruahine Range by Mr Druce in 1973 indicated that the area, which is nearly all above 1,000 m, could appropriately be added to Ruahine Forest Park. The following features, taken together, render the area unique and worthy of reservation:

(i) A varied topography of plateaux, steep and rolling hills, limestone cliffs, streams and waterfalls, peat bogs and tarns.

(ii) A varied vegetation, comprising mainly red tussock grassland and *Dracophyllum* shrubland, with smaller areas of *Libocedrus* forest, celery-pine forest, beech forest and herbfield.

(iii) The good condition of the vegetation.

(iv) The complete absence of introduced woody plants, such as *Pinus contorta,* gorse, broom and sweet brier.

(v) The presence of a large subalpine peat bog (Reporoa Bog). This bog, both for its own sake—it supports some 140 species of higher plants—and for the scientific potential of working out the history of the vegetation through the study of fossil pollen, should not be drained (as has been proposed by the present owner).

(vi) A rich flora comprising 370 species of vascular plants, mostly herbaceous.

(vii) The presence of many rare or uncommon plants, including two local endemics, and six known from the South Island, but not from elsewhere in the North Island.

Surveys of parts of the upper Moawhango River catchment, in the Kaimanawa Range, were made by Mr Druce in January 1973 and January 1974. The Moawhango River runs through what is by far the most diverse area botanically in North Island, with a known flora of higher plants approaching 700 species. The vegetation in the upper Moawhango is tussock-land on broad river-flats (almost of the intermontane-basin type), interspersed with mountain beech forest on the hillsides. Several spectacular gorges have been formed by the Moawhango River and its tributaries. Fire has been the most important factor modifying the original pattern of vegetation. Mountain beech forest probably covered the hills at one time but the broad flats appear not to have been forested, at least not since the Taupo eruption. Wild horses and deer are the main grazing animals at the present time and forests are for the most part severely "eaten-out" by the latter. However, there is very little erosion, except locally on some pumice terraces. The upper Moawhango is mostly Army Reserve. Through the efforts of Botany Division, Nature Conservation Council and N.Z. Forest Service a "gentleman's agreement" seems to have been arrived at whereby the Moawhango West and the valley of the Ngawakaakauae stream will be virtually "out of bounds" for the Army (and anybody else). It should be mentioned that Ngawakaakauae stream is a particularly rich area botanically, where a number of "South Island" plants (i.e. plants known in South Island, but not from elsewhere in North Island) occur e.g., *Carex berggrenii, C. petriei, Agrotis imbecilla, Koeleria novo-zelandica, Ranunculus recens, Oreomyrrhis sp., Myosotis pygmaea* var. *glauca, Luzula rufa* var. *albicomans.* The first *Pinus contorta* trees have appeared on the borders of the upper Moawhango catchment and the Nature Conservation Council has asked Defence Department (April 1974) to declare the catchment a "special area" to be kept clear of *P. contorta* by annual inspections and working parties.

Dr Atkinson prepared a report for the Tawa Borough Council concerning the value and desirability of preserving certain bush remnants in the Tawa district of Wellington.

The question of the current effects that opossums are having on the vegetation and birdlife of Kapiti Island is at present controversial. Ecology Division, DSIR, has initiated a study of the island's opossum population in the absence of trapping and Dr Atkinson is helping to monitor changes in the vegetation as part of this study. The hope is that sufficient information will emerge for a more effective policy of opossum control. A plan has also been proposed for maintaining Rangatira Flat, behind the landing area, largely without woody vegetation, so that the present variety of bird habitats is not reduced.

The control of Mana Island, south of Kapiti, has now passed to

the Ministry of Agriculture and Fisheries, who are using it as an isolation station in testing new breeds of sheep. This island is important biologically in that it lacks all three species of rat that occur in New Zealand, and the Ministry has therefore been recommended to prevent entry of rats, and to protect the steepest part of the coastline as a flora and fauna reserve.

5. Nelson.

Mr and Mrs Kelly have completed field work towards that part of the Biological Survey of Reserves dealing with the Nelson land district. The scale of work proved different from Canterbury, reflecting the very great differences between the land districts. In Canterbury, the reserves are in general pockets of native cover in a rural landscape; in Nelson the rural land is merely a small fringe in the countryside dominated by forested mountains. In addition the great geological, topographic and climatic diversity of the district serves to produce reserves of such interest that a one-day reconnaissance of the style envisaged for Canterbury is rarely practical for any reserve larger than about 40 ha.

A predictable and unsatisfactory aspect of the reserves of the Nelson district is the predominance of forest, in contrast to the limited representation of distinctive regional landscapes characterised by shrub or sedge vegetation. A remarkable feature of the district, however, is the number of important natural areas and vegetation types still available for reservation—a product of the relatively sparse and peripheral settlement of the region. Examples include sedge and scrublands on "pakihis" of the northern West Coast which are threatened by "development" (proposals for a comprehensive reserve in the Four Mile district south of Westport have been submitted); the scrub and forest of the Nelson ultrabasic belt, preferably with the contrasting vegetation of adjoining Permian limestone and greywacke-type rocks (of which only a fragment is reserved in the Aniseed Valley); the distinctive, bleak vegetation/rock mosaics of the upland coal measure plateaux of the Denniston-Stockton district; the moderately fertile and surprisingly weed-free swamp communities of the Whatariki-Mangarakau district, and the adjoining sedge and scrub communities of siliceous hill-soils, both with distinctive floras rich in northern *Baumea* and *Lepidosperma* species.

Perhaps because of the abundance of wild country in Nelson, however, the role of nature reserves in the landscape has not been much appreciated, and even the management of existing reserves has until recently been passive. Thus worthwhile biological details of the region are in danger of being lost. Pending completion of the Nelson account, interim reports have been submitted to the Department of Lands and Survey for a number of reserves where management action is needed, or enlargement of boundaries is desirable. These are listed under "Unpublished Reports Relating to Ecology and Conservation".

Other vegetation surveys in Nelson province have been the responsibility of Mrs Bulfin. She spoke to the Ecological Society on "Some aspects of the vegetation of Farewell Spit", and a short article on the vegetation has been published in *Forest and Bird No. 190:* 19, 1973. Periodic visits have continued. The grass *Spartina* was first noted on the Spit in 1972. Measures taken to eradicate the isolated colonies appear to have been successful, at least on particular areas inspected in June 1974. This grass was planted experimentally in Nelson, as elsewhere, some years ago and it is surprising—and perhaps reassuring—that it has not appeared on Farewell Spit before. Certainly the possibility of re-introduction by birds or machines must be ever present.

A flora of the Gouland Downs was published by Mr Druce and Mrs Bulfin (*Wellington Botanical Society Bulletin No. 38:* 7, 1974), based on the working lists, notebooks and diary of the late W. B. Brockie, supplemented by herbarium specimens collected by H. Talbot and incorporating records and notes made by the authors together with members of the Wellington Botanical Society in January 1973.

An account of vegetation of McKee Memorial Domain, Ruby Bay and a list of species was prepared by Mrs Bulfin at the request of the Domain Board. This small, interesting area of coastal forest, covering a steep face of Moutere gravels and extending onto a beach platform, is a vegetation type not now well represented in the Nelson area. The Domain Board proposes to publish the botanical information together with an account of the geology, Maori use and more recent history of the area.

Although the vegetation of Nelson Haven, the salt marsh area enclosed by the Boulder Bank, was described some years ago, the plants of the Bank itself had not been recorded. Because of the possibility that boulders might be removed from parts of the Bank for filling, the Nelson Branch of the Royal Forest and Bird Protection Society of New Zealand took action. At their request an account of the flora and vegetation of the Bank was prepared by Mrs Bulfin for inclusion in a booklet describing the geology, vegetation, bird life, etc. of this interesting geological feature (published by Cawthron Institute, 1976). Information and assistance was also given to the Society concerning Snowdons Bush at Brightwater, an area of lowland podocarp forest on alluvial river gravels.

A revised and expanded description by Mrs Bulfin of the vegetation of Nelson Lakes National Park was published in December 1974 in the new edition of the Handbook. In the same month, a booklet describing the nature walk to the St Arnaud Range, with drawings by K. R. West, was made available. To assist a group of amateur ornithologists taking part in a bird counting and mapping scheme in the Park, Mrs Bulfin gave lectures on the vegetation, on the identification of divaricating shrubs, and on the identification of fruits and seeds that could be eaten by birds. The group was also

accompanied on field trips. A species list of higher plants, mosses, some liverworts and lichens is being prepared.

Finally, Mrs Bulfin has completed field work for nature walk brochures for the Department of Lands and Survey on the botany of Wainui Falls area in Abel Tasman National Park, and the Lewis Pass Scenic Reserve.

6. Marlborough.

The 828 ha Whites Bay Domain, on the Port Underwood road between Blenheim and Picton, includes a large area of scrub, and Mr Kelly was asked to assess the quality and regeneration potential of the present vegetation, because exotic afforestation had been proposed. Much of this scrub is manuka, extensive stands of which are becoming scarcer year by year, and this coupled with good regeneration potential and the coastal situation of the block, suggests that afforestation is not appropriate. Addition of the area to the Marlborough Sounds Maritime Park has been proposed.

7. Westland.

Mr June is conducting a botanical survey in lowland beech-podocarp and podocarp-hardwood forest which is currently being exploited for timber or included in the Beech Utilization Proposals of the N.Z. Forest Service. Existing Scenic Reserves and proposed Biological and Amenity Reserves have been inspected and recommendations are being prepared for additional reserves to ensure that adequate and viable areas of the original ecosystems are preserved.

Dr Wardle has almost completed field work in Westland National Park, and his present efforts are towards writing up the results. A study of Holocene glacial advances and retreats has been published (*N.Z. Journal of Botany 11:* 349, 1973), with the object of providing a chronological basis for the description of plant succession. A list of vascular plants for the Park and adjoining coastal and lowland areas annotated with ecological, distributional and taxonomic information, is ready for publication and contains about 620 indigenous species, about 20 additional varieties and 25 hybrids, and over 110 adventive species (*N.Z. Journal of Botany 13:* 497, 1975). A gratifying occurrence over the period has been the spectacular recovery of subalpine and alpine vegetation, following reduction in numbers of deer, chamois and thar. On the other hand, the extent of killing of canopy trees by opossums continues to increase, and most of the Hall's totara trees in the Park are dead or dying through unidentified causes.

8. Canterbury.

Mr and Mrs Kelly's Biological Survey of Reserves in Canterbury culminated in the publication of 'Scenic Reserves of Canterbury" in 1972. This important contribution to conservation provides maps, brief descriptions and species lists for 60 scenic and allied reserves

together with 10 further areas of interest, ranging from domains to islands in lakes.

Dr Molloy is continuing the surveys noted in the Triennial Report for 1969-71. The systematic botanical survey of the Canterbury Plains has now been extended to cover the Canterbury land district as a whole. This approach is considered desirable in order to assess objectively the conservation status of species and communities, and is followed through in conjunction with surveys of the land district for new or potential reserves. In preparation are lists covering such items as type localities, endemic and rare species, and species with geographic limits in Canterbury. The ultimate object is to map and describe the vegetation and flora. This will help to meet the increasing demand for botanical information and ecological assessment covering land administered by the Department of Lands and Survey, N.Z. Forest Service, various local bodies and district planners.

Particular attention has been devoted to the Mackenzie Basin, in view of the radical changes being made in this unique landscape by the mammoth Upper Waitaki hydro-electric scheme. Several reserves covering some of the important Mackenzie plant communities are presently being negotiated. Of special significance in other parts of the land district are the coastal regions and other areas likely to be affected by major development projects such as irrigation, hydro-electric, and recreation including skiing. Some existing reserves are also being re-examined with a view to change of status, extension of boundaries, etc., as a follow-up of the Biological Survey of Reserves.

It is proposed to describe all new reserves in Canterbury as they are gazetted. The first contribution to the "Biological Reserves of New Zealand" series in the *N.Z. Journal of Botany*—Eyrewell Scientific Reserve, Canterbury—was submitted to stimulate further descriptions of reserves elsewhere in New Zealand.

Dr Molloy has continued the botanical study of Peel Forest Park, with the ultimate objects of mapping and describing the vegetation and flora, and historical reconstruction. The flora is being treated systematically in conjunction with the series of field guides for park interpretation. The first of these, dealing with ferns and fern allies, is nearly completed. The fern flora is relatively rich, comprising 61 species and including most of the growth forms.

Mr H. D. Wilson has been employed by Mount Cook National Park Board to make a vegetation survey under the guidance of Mr Connor. Field work began in 1969, and Mr Wilson has now published his results (National Parks Authority Scientific Series No. 1, 1976).

9. Otago and Southland.

Initial vegetation studies have been made by Dr Hubbard in the Clutha valley in relation to proposed hydro-electric development. Association analysis of 220 sites has been made, the interaction of adventive and native species is documented, and rare native plants

have been searched for. Dr Hubbard has also been involved with studies of salt marshes dominated by *Spartina* and by other plants.

In relation to proposals for new reserves, red tussock grasslands in the Mavora Hills (Dr Johnson) and bogs on the Awarua Plains (Dr Hubbard) have been studied, and reports submitted to the Department of Lands and Survey. These officers have also assisted with environmental impact reports relating to Hamilton Burn Catchment (land development), the Remarkables (proposed ski field), Waipori Station (land development), Makarora Valley (soil conservation and flood control) and Lindsays Creek near Dunedin (flood protection works).

A co-ordinated list of existing reserves in Otago/Southland, is being drawn up. As a basis for assessing botanical reserve requirements, vegetation maps (1 inch to 1 mile) are being prepared, incorporating all botanical information available to date.

Fiordland National Park is the scene of much activity by Botany Division staff. Dr Given has continued field work at Lake Shirley, south of Caswell Sound, and revised his list of species of the area (*N.Z. Journal of Botany 10:* 559, 1972). Early in 1972 he accompanied the N.Z. Forest Service expedition searching for moose near Dusky Sound. Botanists on Cook's second voyage in 1774 had collected from some of the localities visited, but others were unknown botanically. A total of 700 specimens were collected, some being new records for Fiordland. A list of Fiordland ferns is being written up.

During the period, Dr Wardle has continued surveys in Western Fiordland with Professors G. T. S. Baylis and A. F. Mark of the University of Otago. In 1972 the vegetation of West Cape was described and the results published (*N.Z. Journal of Botany 11:* 599, 1973), while in 1974 Poison Bay and deer-free areas around Milford Sound were visited.

In 1972 Dr Atkinson reported on ecological consequences of operating Lake Manapouri at a level of more than 2 m below its present mean level. A commitment to intensive research in this field began in 1973, when Dr Johnson was appointed to study the likely effects of manipulation of lake levels. He has set up permanent transects and photo-points around Lakes Te Anau and Manapouri, with a view to understanding and monitoring natural and induced changes in the habitat and the consequent plant successions. Vegetation on other Fiordland lake shores (particularly Monowai, Hauroko and Poteriteri, but also many smaller ones) is being studied.

Besides the lake shore work, Dr Johnson has made vegetation studies on Solander Islands and on Breaksea Island, also in Fiordland National Park. Occurrence and spread of adventive plants in Fiordland is being documented. Advice has been given on aquatic weeds and plant specimens have been donated to the Park herbarium.

10. Chatham Islands.

A visit to the Chathams by Mr Kelly to discuss the District Scheme

allowed an all-too-brief aerial reconnaissance of the southern tablelands. The dry summer of 1972-73 resulted in perhaps 20-25% of the *Sporadanthus-Dracophyllum-Olearia* rush-land being burnt. The policy of acquiring broad familiarity with the two main islands (Chatham and Pitt) has proved a worthwhile investment, as for example in the case of Glory Block, Pitt Island, where a careful re-assessment of land-use potentials, coupled with suggested zoning for reserve and development, provided a formula whereby the Department of Lands and Survey was able to reconcile the strongly conflicting claims for the future of the block, and to proceed with purchase. This department has also now acquired two further blocks (Te Awatea, and Wharekauri—the former Chudleigh Estate) on Chatham Island, primarily for farming development, but both areas offer scope for nature reserves. In addition, certain of the proposed reserves noted in the previous report have been acquired, and there is scope for guarded optimism that an initial core of representative reserves will be set aside by the time of the next Triennial Report. Securing adequate areas of the unique bog landscape remains the central task.

The total world populations of Chatham Island black robin and Forbes' parakeet (less than 20 robins and probably less than 30 parakeets) survive on Little Mangere Island (22 ha) in the Chatham group. High mortality in some of the trees on the island is further restricting the birds' habitat. In collaboration with Wildlife Service, Dr Atkinson has begun an investigation into the reasons for the tree deaths, and recommendations have been made concerning the re-afforestation of part of the neighbouring Mangere Island with a view to providing new habitats for these birds.

11. Southern Islands.

Following the 1972-73 Auckland Islands Expedition a revised list of vascular plants has been prepared for the islands. The list includes several new plant records and collates previously scattered records, particularly of adventive plants. Patterns of colonisation and spread of adventive plants have been studied, and indicate that several New Zealand taxa are probably adventive to the Auckland Islands.

12. Other ecological studies.

(a) Timberline studies (Dr P. Wardle and Mr A. D. Campbell).

The first phase of an experiment on the effect of altitude on growth and survival of tree seedlings has been completed, as indicated in the Triennial Report for 1969-71. For the next few years, subsequent growth and vigour of the established seedlings on the Craigieburn Range will be followed. A question which arose from the timberline study concerns the reasons for the inherent differences in maximum height of woody species. To investigate this, the *Hebe* collection built up at the Division by Dr L. B. Moore and Mr I. C. Brown is being used in experiments, conducted jointly with Dr J. D.

Mann of Applied Biochemistry Division, to determine the effects on height of various growth substances and treatments such as layering and grafting.

Problems concerning the relationship of alpine and inverted timberlines have been studied by following the changes in tolerance to low temperature of shoots of *Nothofagus solandri* var. *cliffortioides, Phyllocladus alpinus* and *Dacrydium bidwillii* (*Proceedings of the N.Z. Ecological Society 23:* in press, 1976). The breaking of bud dormancy in seedlings of *N.s. cliffortioides* has been studied in controlled environment chambers at Lincoln College (*N.Z. Journal of Botany 14:* 183, 1976).

(b) Pioneer vegetation on moraines in British Columbia (Dr D. R. Given).

A paper dealing with pioneer vegetation on the moraines of Clachnacudainn Snowfield, Selkirk Mountains has been published (*Syesis 8:* 349, 1975). This shows that vegetation is probably established from chance propagules dispersed from neighbouring forest and herbfield. *Dryas* and some other genera recorded in similar studies of western North America moraines are notably absent. This probably reflects the greater altitude of the Clachnacudainn sites (2,000-2,200 m). Of interest is that some of the moraine colonisers are plants rare in this part of British Columbia, and several are new records for the mountain system.

(c) Phenology (Mr A. D. Campbell).

The following information is being gathered from labelled trees on various sites at Peel Forest: vegetative growth of totara (*Podocarpus totara*), *matai* (*P. spicatus*) and kahikatea (*Dacrycarpus dacrydioides*); flowering and fruiting in the same species, together with southern rata (*Metrosideros umbellata*); and germination and seedling survival, especially of podocarps.

Many large herbs in New Zealand appear to flower heavily at intervals of about 3 years, with little or no flowering between. This is being checked with labelled plants of *Celmisia, Aciphylla* and *Chionochloa* in the Craigieburn Range.

(d) Parasitic plants (Dr B. P. J. Molloy).

Studies of the biology and ecology of the native mistletoes have continued. Three projects are in progress: analysis of herbarium and live material to determine distribution and host range; chlorophyll analysis of leaves, stems and endophytic parts (with Professor B. H. Howard, Department of Biochemistry, Lincoln College); ultrastructure of the endophyte in *Korthalsella* (with Dr B. A. Fineran, Department of Botany, University of Canterbury). Three species are now established in the Experimental Gardens at Lincoln. It is proposed to establish the remaining species either by transplanting hosts with parasites attached, or to inoculate parasites onto established hosts. One species, *Trilepidea adamsii* (=*Elytranthe adamsii*), may well be extinct. It was last collected in 1962.

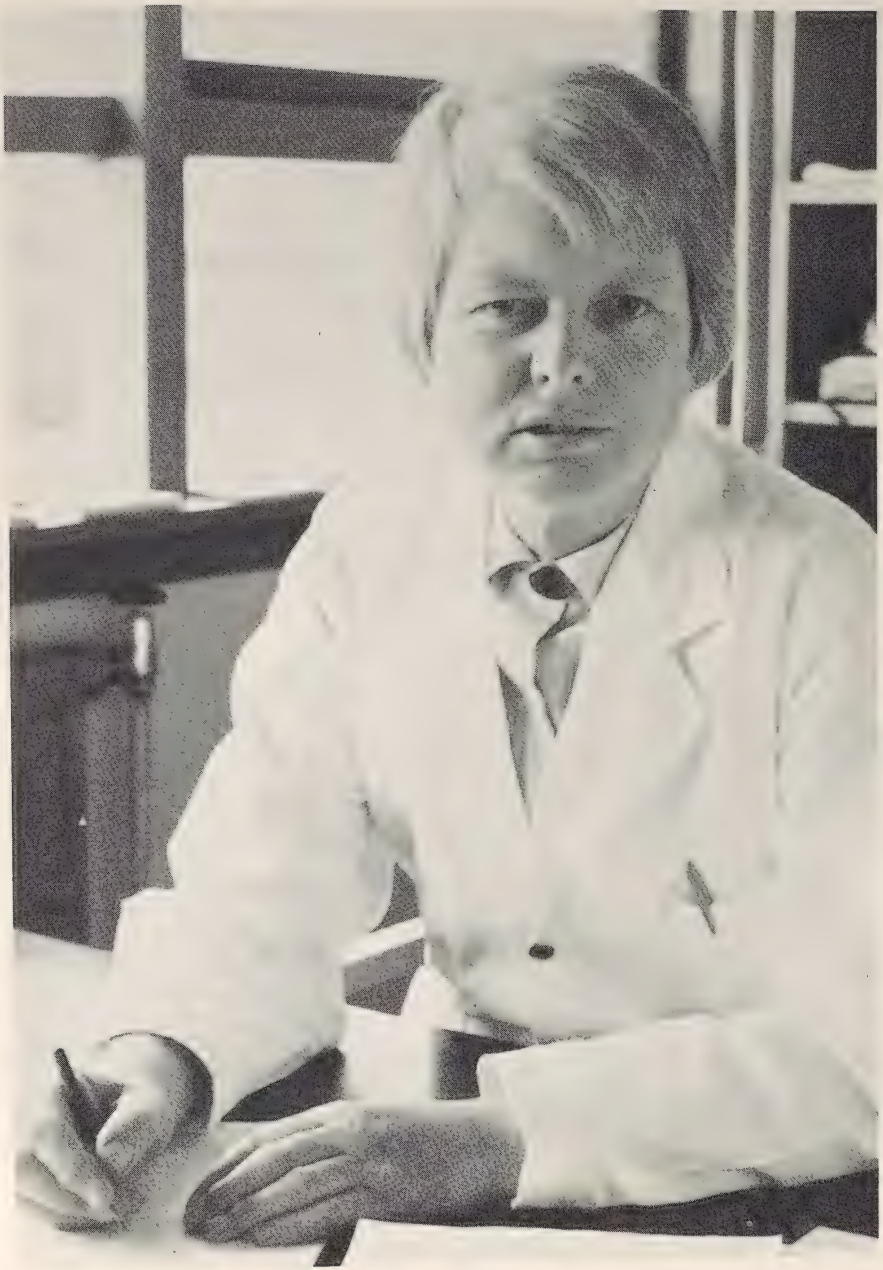

Photo: J. Somers Cocks

Miss Ruth Mason, B.A., M.Sc. (N.Z.) joined Botany Division on 24 January 1939 and retired on 24 January 1974.

Photo: C. J. Miles

Dr J. B. Hair, M.Sc. (N.Z.), Ph.D. (London) joined Botany Division on 7 August 1947 and retired on 27 March 1974.

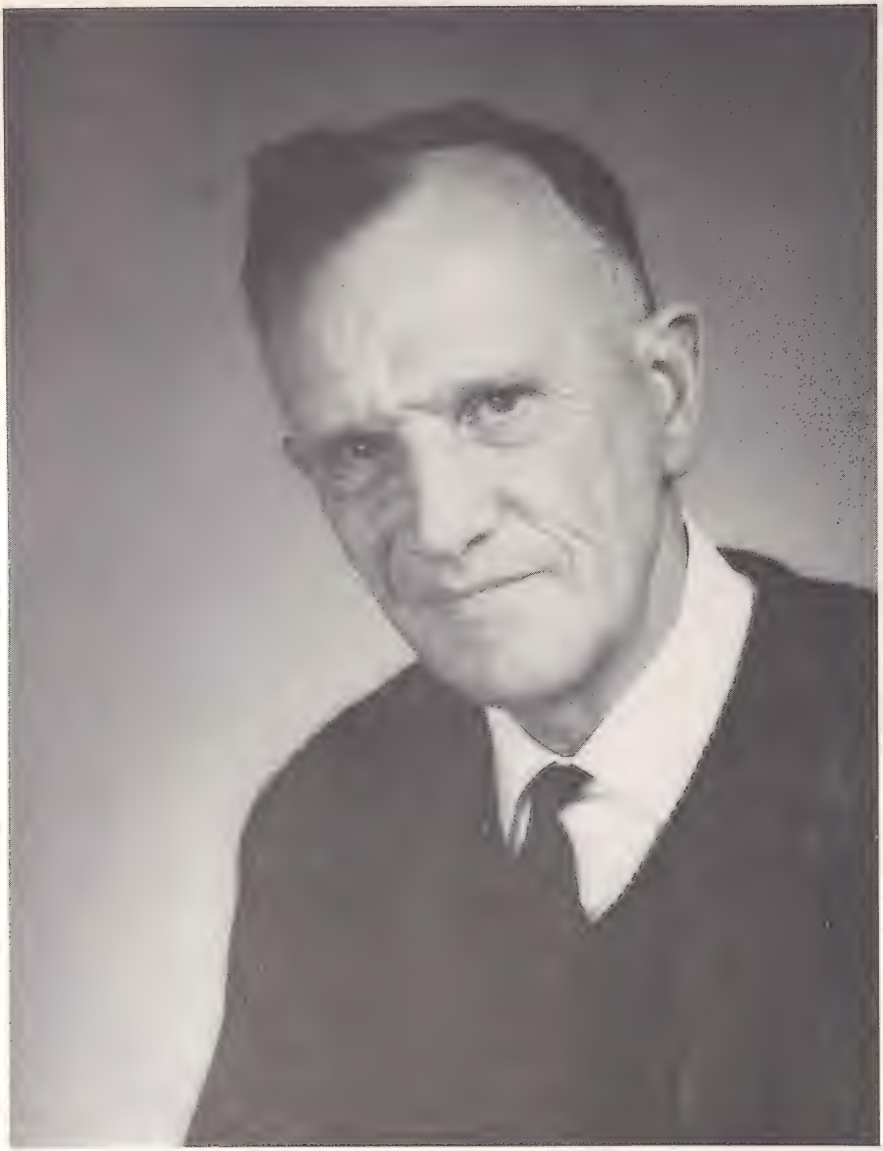

Photo: J. Somers Cocks

Mr T. W. Rawson, M.Sc. (N.Z.) joined Botany Division on 12 November 1945 and retired on 14 March 1975.

Photo: J. Somers Cocks

Dr D. G. Drury, B.Sc., Ph.D. (Southampton) was appointed to Botany Division on 17 February 1967 and resigned on 31 January 1974.

(e) Regeneration and migration studies in West Coast beech forests (Mr S. R. June).

A long-term study has begun in beech-podocarp forest in the Grey Valley, North Westland. This involves mapping and tagging all seedlings and trees of the major canopy species red beech (*Nothofagus fusca*), hard beech (*N. truncata*), rimu (*Dacrydium cupressinum*), miro (*Podocarpus ferrugineus*) and southern rata (*Metrosideros umbellata*)) within plots to provide data on the patterns and rates of regeneration. All four beech species appear to be migrating southward and invading podocarp-hardwood forest in this area as part of vegetation change since the last ice age. The modes and present rates of migration are being studied.

(f) Spread of ship rats in New Zealand (Dr I. A. E. Atkinson).

As a result of an intensive re-examination of historical data concerning rats, it was concluded that the ship rat or black rat (*Rattus rattus*) did not spread through New Zealand until after 1860, more than 60 years after the time they have usually been thought to have spread (*Journal of the Royal Society of N.Z. 3:* 457, 1973). It is now a definite possibility that some major declines of native forest birds which occurred last century were a result of the spread of this rat but more work remains in order to prove the case for particular species. The implication for plant regeneration of a late rather than early spread of ship rats have still to be examined.

(g) Kakapo (Dr I. A. E. Atkinson in collaboration with Wildlife Service and Mr P. A. Williams).

The ground-parrot or kakapo is in imminent danger of extinction. Reports have been prepared arguing that establishment of kakapo on certain islands, free of introduced predators and herbivores, is the course of action most likely to succeed in saving this unique bird. Intensive work on the habitat of kakapo has been carried out in the Milford catchment with the aim of identifying features that might explain why they have survived there in higher numbers than elsewhere. Wildlife Service have transferred kakapo to an island in the Marlborough Sounds where they appear to be surviving satisfactorily but at the time of writing there is still no certainty that any female birds have been found.

(h) Conservation of rare and endangered plants (Dr D. R. Given).

The visit to New Zealand in 1972 by Dr R. Melville (Royal Botanic Gardens, Kew) stimulated interest in rare and endangered plants. Since then a scheme has begun to document these and the reports compiled will be published. The first 50 reports have been completed. As a result of this survey some species reputed to be rare have been found to be far more widespread than previously thought. Several are now known to be in danger of extinction in the wild, e.g., *Celmisia macmahonii, Clianthus puniceus* and *Gunnera*

hamiltonii, and two others (*Hebe breviracemosa* and *Trilepidea adamsii*) are possibly extinct. A preliminary sorting indicates that probably about 200 plant species native to the New Zealand botanical region are either sufficiently rare or endangered to demand attention in the near future, although the excellent reserves system in New Zealand has ensured the survival of adequate populations of many of these. While overseas in 1973 and early 1974 Dr Given was able to discuss with others working in this field the documentation and regeneration of rare plants. Particular attention was paid to various ways of quantifying such terms as "rare" and "endangered', and to means of interesting the public in rare plant conservation. In dealing with rare and endangered plants emphasis is placed on four aspects of their conservation: documentation, preservation including reservation, legislation and education.

(i) Lichens (Dr D. J. Galloway).

A comprehensive survey of the ecological and phytogeographical relationships of the New Zealand lichen flora is envisaged. Since lichens are sensitive indicators of many kinds of environmental disturbance a series of *indicator* quadrats will be established in various parts of New Zealand to monitor the effects of environmental change. A series of reports on lichen vegetation in various parts of New Zealand are being prepared for publication. These include the Three Kings Islands (visited in 1970); Dusky Sound (visited in 1969) and the southern mountains of Stewart Island, the Tin Range, Mt Allen and Deceit Peaks (visited in 1969).

UNPUBLISHED REPORTS RELATING TO ECOLOGY AND CONSERVATION

Atkinson, I. A. E. 1972: Bush Remnants at Tawa. 10 pp.

Atkinson, I. A. E. 1972: Ecological Consequences of the Rising Lake Level at Lake Okataina, Rotorua. 6 pp.

Atkinson, I. A. E. 1972: Notes on Vegetation and the Effects of Animals in the Central Raukumara Range. 10 pp.

Atkinson, I. A. E. 1972: Proposed Changes to Boundaries of Tongariro National Park. 2 pp.

Atkinson, I. A. E. 1972: Recommendations for Use and Protection of Islands in Hauraki Gulf Maritime Park. 11 pp.

Atkinson, I. A. E. 1972: Report on Mahurangi Island, Mercury Bay. 9 pp.

Atkinson, I. A. E. 1972: Report on Waimangu Reserve. 12 pp.

Atkinson, I. A. E., Daniel, M. J., Gibb, J. A. and Whitaker, A. H. 1972: Report on the Future Status of Mana Island. 3 pp.

Atkinson, I. A. E. and Williams, P. A. 1972: Supplementary Report on Suitability of Islands for Kakapo. 6 pp.

Gibb, J. A. and Atkinson, I. A. E. 1972: Proposed Reservation of Mana Island. 2 pp.

Gibb, J. A., Atkinson, I. A. E. and Miers, K. H. 1972: Effects of Opossums on the Vegetation of Kapiti Island. 3 pp.

McKellar, I. C., Collins, N. W., Atkinson, I. A. E. and McKenzie, G. R. 1972: Report of Party to Investigate Manapouri Shoreline. 8 pp.

Atkinson, I. A. E. 1973: Report on Scientific and Wildlife Value of the Islands Between Doubtless Bay and Cape Brett. 5 pp.

Atkinson, I. A. E. 1973: Report on Vegetation Management in the Reserve at Te Porere Redoubt. 8 pp.

Atkinson, I. A. E. 1973: The Need for a Swamp Reserve at Plimmerton. 4 pp.

Atkinson, I. A. E. 1973: Transfer of Little Spotted Kiwi to Suitable Islands. 8 pp.

Atkinson, I. A. E., Bell, B. D., Bull, P. C., Daniel, M. J., Gibb, J. A. and Whitaker, A. H. 1973: Guidelines for Protecting Mana Island. 4 pp.

Atkinson, I. A. E., Flack, J. A. D., Bell, B. D. and Brown, W. 1973: Tree Planting Needed on the Mangere Islands (Chatham Group) to Ensure Survival of the Black Robin and Forbes' Parakeet. 7 pp.

Atkinson, I. A. E. 1974: Application to Quarry at Cape Turakirae. 2 pp.

Atkinson, I. A. E. 1974: List of Plants Found in the Esperance Valley, Fiordland, During March 1974. 8 pp.

Atkinson, I. A. E. 1974: Management of Vegetation at Rangatira Point, Kapiti Island. 8 pp.
Atkinson, I. A. E. 1974: Motunau Island, Canterbury. 2 pp
Atkinson, I. A. E. 1974: Report on Proposed Reserve Area: Convent of Mercy Trust Board. 1 pp.
Atkinson, I. A. E. and Merton, D. V. 1974: Interim Report on Kakapo Habitat in the Esperance Valley, Fiordland. 5 pp.
Whitaker, A. H. and Atkinson, I. A. E. 1974: Pencarrow Block, Wainuiomata—Comments on the Environmental Impact Report. 2 pp.
Atkinson, I. A. E. 1975: Report on Visit to Raoul Island, July 24-25, 1975. 6 pp.
Atkinson, I. A. E. 1975: The Hauraki Gulf Islands: A Limited and Fragile Resource. 5 pp.
Atkinson, I. A. E. 1975: Vegetation Surveillance for Kapiti Opossum Study. 6 pp.
Atkinson, I. A. E., Daniel, M. J., Meads, M. J. and Whitaker, A. H. 1975: Mana Island: April 1975. Report of DSIR Party. 17 pp.
Bell, B. D. and Atkinson, I. A. E. 1975: Proposals for Increasing the Diversity of Wetland Habitats on Kapiti Island. 4 pp.
Bell, B. D. and Atkinson, I. A. E. 1975: Report on the Rangatira Swamp, Kapiti Island. 2 pp.
Bulfin, M. J. A. 1971: Report on Visit to Farewell Spit January 22-23rd 1971. 3 pp.
Bulfin, M. J. A. 1974: Report on a Visit to Farewell Spit 27.2.74. 1 pp.
Druce, A. P. 1972: Indigenous Vascular Plants from Baring Head to Turakirae Head to Windy Point, South Wellington Coast, Sea Level to 500 ft. 6 pp.
Druce, A. P. 1973: Check List of the Higher Plants of Mount Egmont. Including Pouakai and Kaitake Ranges (From Sea Level to the Summit). 68 pp.
Druce, A. P. 1973: Notes on Proposed Scenic Reserve, Leith Road, Western Taranaki Coast. 10 pp.
Druce, A P 1974: Proposed Addition of Part of NW Ruahine Range to Ruahine Forest Park.
Druce, A. P. 1974: Vascular Plants of Limestone Plateau, NW Ruahine Range, 3,500-4,350 ft. 11 pp.
Druce, A. P. 1974: Vascular Plants of Reporoa Bog, NW Ruahine Range. 4 pp.
Druce, A. P. 1975: Report on the State of the Native Bush at Trentham Memorial Park. 3 pp.
Esler, A. E. 1972: Whangaruru North Head. 23 pp.
Esler, A E. 1973: Comments on Environmental Impact Report: Gulf Harbour Reclamation, 2 pp.
Esler, A. E. 1973: Botanical Features of the Islands West of Coromandel Peninsula. 140 pp.

Esler, A. E. 1973: Some Significant Exotic Trees at Mansion House Bay, Kawau Island. 2 pp.
Esler, A. E. 1974: Motuihe Island. 23 pp.
Esler, A. E. 1974: Motukorea (Browns Island). 12 pp.
Esler, A. E. 1975: Pingao in Northland. 2 pp.
Esler, A. E. 1975: Te Paki-Mokaikai. 6 pp.
Given, D. R. 1972: Botanical Investigations in Wet Jacket Arm and Dusky Sound, Fiordland. February 1972. 23 pp.
Godley, E. J. 1973: Planting Natives in Scenic Reserves. 2 pp.
Godley, E. J. and Atkinson, I. A. E. 1963: Report on Otito Reserve, North Auckland. 3 pp.
Healy, A. J. 1971: Beware of Aquatic Weeds. *In* The Noxious Weeds Inspectors Institute Newsletter Vol. 1, No. 4, pp. 1-3.
Healy, A. J. 1972: Identification of Noxious Weeds. 36 pp.
Healy, A. J. and Shillito, N. L. 1974: Importation of Amenity Grasses. 14 pp.
Hubbard, J. C. E. 1974: Biological Implications of Hydro-electric Development Along the Clutha River. 4 pp.
Hubbard, J. C. E. 1974: Botanical Reconnaissance of the Awarua Plain Invercargill. 10 pp.
Hubbard, J. C. E. 1975: Interim Report on Vegetation Studies in the Clutha Catchment. 4 pp.
Johnson, P. N. 1974: Botany of the Matukituki Valley. 12 pp.
Johnson, P. N. 1974: Report on a Visit to Hamilton Burn. 3 pp.
Johnson, P. N. 1974: Report on a Visit to Solander Islands November 10-25 1973. 16 pp.
Johnson, P. N. 1974: Report on Proposed Red Tussock Reserve, Mavora Hills Farm Settlement. 11 pp.
Johnson, P. N. 1975: List of Plants Found in Sinbad Gully Fiordland, February 1974. 9 pp.
Johnson, P. N. 1975: Report on a Visit to Breaksea Island and Adjacent Islands, Fiordland, December 1974. 15 pp.
Johnson, P. N. 1975: Report on Kakapo Habitats in Sinbad Gully, Fiordland. 11 pp.
Kelly, G. C. 1967: The Natural History of the North Cape Area. 18 pp.
Kelly, G. C. 1971: Cape Palliser. 3 pp.
Kelly, G. C. 1971: Survey of Reserves/Supplementary Comments. Sign of the Packhorse. 2 pp.
Kelly, G. C. 1973: Description of Chatham Island Vegetation. *In* New Zealand Forest Service, Forest Research Institute, Forest Mensuration Report No. 22, pp. 53-4.
Kelly, G. C. 1973: Farewell Spit. 9 pp.
Kelly, G. C. 1973: Four Mile Scenic Reserve. 11 pp.
Kelly, G. C. 1973: Lewis Pass Scenic Reserve. 4 pp.
Kelly, G. C. 1973: Pitt Island. 3 pp.
Kelly, G. C. 1973: Proposed Red Tussock Reserve—Mavora Farm Settlement. 3 pp.

Kelly, G. C. 1973: Proposed Reserves in the Chatham Islands. Annotated Map.
Kelly, G. C. 1974: Farewell Spit—Supplement. 5 pp.
Kelly, G. C. 1974: Heaphy River. 2 pp.
Kelly, G. C. 1974: Karamea Bluff. 2 pp.
Kelly, G. C. 1974: Motunau Island—Canterbury. 1 pp.
Kelly, G. C. 1974: Nile River Caves. 2 pp.
Kelly, G. C. 1974: Paynes Ford. 4 pp.
Kelly, G. C. 1974: Punakaiki. 3 pp.
Kelly, G. C. 1974: Punakaiki Scenic Reserve—Roading. 4 pp.
Kelly, G. C. 1974: Reserves—Chatham Islands. 4 pp.
Kelly, G. C. 1974: Riverview (Murchison) Domain. 2 pp.
Kelly, G. C. 1974: Shenandoah Saddle. 2 pp.
Kelly, G. C. 1974: Snowdens Bush. 1 pp.
Kelly, G. C. 1974: *Spartina* Survey and Control—Golden Bay District. 2 pp.
Kelly, G. C. 1974: Spirits Bay and Mokaikai. 6 pp.
Kelly, G. C. 1974: Transmission Lines to West Coast. 4 pp.
Kelly, G. C. 1974: Upper Buller Gorge. 4 pp.
Kelly, G. C. 1974: Warbeck or Maruia Saddle (and Proposed Additions). 2 pp.
Kelly, G. C. 1974: Whites Bay Domain, Marlborough. 3 pp.
Kelly, G. C. 1975: Afforestation or Pastoral Development at Mokaikai-Spirits Bay. 5 pp.
Kelly, G. C. 1975: Proposed Airport at Karewa Point. 2 pp.
Macmillan, B. H. and Watt, J. C. 1972: Proposed Biological Reserve in the Inangahua East State Forest 130, at Capleston near Reefton. 12 pp.
Mason, R. 1968: Report on Stomach Contents of Opossums from the Urewera. 10 pp.
Mason, R. 1970: List: Some Littoral Aquatics in Rotorua Lakes. 4 pp.
Mason, R. 1973: Report on Water Plants on Sale in New Zealand—1973. 4 pp.
Moar, N. T. Burrows, C. J. and Dobson, A. T. 1973: Wetlands in Lands and Survey Development Blocks, Te Anau-Manapouri Area. 11 pp.
Moar, N. T. 1975: Conservation of Wetlands. 1 pp.
Molloy, B. P. J. 1971: Proposed Reserve: Lindis Pass. 2 pp.
Molloy, B. P. J. 1973: Clutha River Development Scheme Study Group: Five—Preliminary Report. 5 pp.
Molloy, B. P. J. 1973: Palm Gully Reserve. 5 pp.
Molloy, B. P. J. 1973: Proposed Reserve—Jacks Pass. 7 pp.
Molloy, B. P. J. 1973: Raules Gully Scenic Reserve. 6 pp.
Molloy, B. P. J. and Sykes, W. R. 1973: Report on Survey of Trees Suitable for Registration in the Riccarton Borough. 4 pp.
Molloy, B. P. J. 1974: Forest Walk—Mt Isobel. 14 pp.
Molloy, B. P. J. 1974: List of Plants—Proposed Pukaki Village. 5 pp.

Molloy, B. P. J. 1974: Possible Extensions to Summit Road Reserves. 2 pp.
Molloy, B. P. J. 1974: Proposed Scientific Reserve Quailburn—North Otago. 4 pp.
Molloy, B. P. J. and Hislop, W. F. 1974: Proposed Scientific Reserve —North Otago. 8 pp.
Molloy, B. P. J. and Sykes, W. R. 1974: Report of Survey of Trees Suitable for Registration in the Merivale District, Christchurch. 31 pp.
Molloy, B. P. J. 1975: Carews Peak Reserve Extension. Botanical Notes. 1 pp.
Molloy, B. P. J. 1975: Check List of Plants Little Akaloa Extension. 2 pp.
Molloy, B. P. J. 1975: Check List of Plants Otepatotu Extension. 2 pp.
Molloy, B. P. J. 1975: Proposed Scenic Reserve—Lake Pukaki. 4 pp.
Molloy, B. P. J. 1975: Proposed Scientific Reserve—Castle Hill Run. 4 pp.
Molloy, B. P. J. 1975: Sharplin Falls Scenic Reserve Extensions. 1 pp.
Molloy, B. P. J. 1975: Survey of Silver Beech S.F. 32 Alford. 3 pp.
Molloy, B. P. J. 1975: Town and Country Planning. Lyttelton Borough: Reserves. 3 pp.
Molloy, B. P. J. 1975: Water Abstraction from the Wairau River. 2 pp.
Moore, L. B. 1972: *Calochilus paludosus* and the Four Mile Scenic Reserve. 3 pp.
Park, G. N. 1975: Biological Reserves in Lowland Forests in the Nelson Land District—Suggestions for Priority Reservation. 6 pp.
Park, G. N. 1975: Ecological Comments of Planting Programme in Abel Tasman National Park. 2 pp.
Park, G. N. 1975: Ecological Studies in the Ohikanui Valley. 12 pp.
Park, G. N. 1975: Proposals for the Reservation of Ecological Features Dun Mountain Ultramafic Area. 8 pp.
Park, G. N. and Walls, G. Y. 1975: Comments on the Botany and Ecology of Indigenous Forest, Former Richmond Water Catchment Reserve (Reservoir Creek). 7 pp.
Park, G. N. and Walls, G. Y. 1975: Preliminary Ecological/Botanical Comments on Wetland Area: Section 18 Block III Burnett S. D., Maruia Valley. 6 pp.
Parsons, M. J. 1973: Appendix I to Marine Algae Report on a Visit to Solander Islands November 10-25, 1973. 2 pp.
Sykes, W. R. 1972: Report on Eastwoodhill Estate. 3 pp.
Wardle, P. 1964: Scenic Reserves in the Catlins District. 4 pp.
Wardle, P. 1972: Landsborough and Clarke Valleys, February 1972. 4 pp.
Wardle, P. 1972: Report on Proposed Additions to Four Mile Scenic Reserve, Buller County. 5 pp.
Wardle, P. 1973: Comments on Reports on the Shoreline Vegetation of Lakes Manapouri and Te Anau. 7 pp.

Wardle, P. 1973: Damage by Opossum in the Waiho Valley. 4 pp.
Wardle, P. 1973: Diversion of Waitangitaona River in Relation to National Park Values—Report to Westland National Park Board. 4 pp.
Wardle, P. 1973: Report on the Botanical Survey of Westland National Park during 1972-73. 3 pp.
Wardle, P. 1974: Comment on Application for Prospecting Licence in the Balfour Area of Westland National Park. 2 pp.
Wardle, P. 1974: Science in Westland National Park. Report to Westland National Park Board. 2 pp.
Wardle, P. 1975: Botanical Implications of the Proposed Maniototo Irrigation Scheme. 4 pp.
Wardle, P. 1975: Omotumotu and Aorangi Scenic Reserves—Proposed Extensions. 3 pp.

PALYNOLOGY AND QUATERNARY BOTANY

(Dr N. T. Moar)

Although the main palynological effort in Botany Division involves studies in Quaternary Research other fields of palynology are not neglected. The most important of these is pollen morphology. Our interest in pollen morphology stems from the demands of pollen identification and of taxonomy and to meet these we maintain a collection of reference slides of pollen grains and spores in which the angiosperms are best represented.

There have always been requests for help in pollen identification, but during the last few years an increasing number of students have sought advice in connection with M.Sc. or Ph.D. theses. These requests emphasise the fact that there is no comprehensive work describing the pollen grains of dicotyledonous plants in the New Zealand flora although there are available detailed accounts of the fern spores and pollen grains of the monocotyledons. To fill this gap we have decided to prepare an account of gymnosperm and dicotyledon pollen grains using scanning and transmission electron microscopy in addition to the conventional techniques of bright field and phase contrast. It is expected that this project, regarded as an extension of the series of floras published by Botany Division, will be completed in about five years.

Quaternary studies have been pushed forward vigorously and areas investigated by M. S. McGlone have added much to our understanding the history of vegetation and climate in New Zealand. His studies

in central North Island involving sites more than 40,000 years old are of particular interest and emphasise the changing pattern of vegetation as it responds to changing climatic conditions involving both temperature and effective precipitation. Further, we can now view South Island sites spanning similar periods of time in better perspective, and believe that similar climatic events, differently expressed, can be recognised in both islands. Whatever conclusions are drawn from future, and hopefully, more detailed work, it is clear that the history of our vegetation during the last glaciation was a complex one.

As our knowledge of post-glacial patterns of vegetation are becoming known we are better able to interpret these in terms of climate. In this context it is important to note that relatively minor species in our forests which are sensitive to particular climatic factors are proving of especial interest. Further, study of the ratio of one pollen type to another, e.g. as between *Dacrydium cupressinum* and *Podocarpus,* is proving useful in reconstructing the broad outline of climatic change.

Since the recognition of fire as an important factor in the history of post-glacial vegetation, studies involving both pollen and charcoal in conjunction with intensive field work, have been actively continued. The work of B. P. J. Molloy with subfossil charcoal provides abundant evidence of man-made fires during the last 500 years and of natural fires which extend back into the last glaciation. M. S. McGlone has palynological records of fires which occurred several thousand years ago in Otago.

Correct interpretation of pollen diagrams is central to our Quaternary studies. As an aid in this we sample for current pollen rain at any site under investigation and in addition a pollen trapping programme has been carried out by J. V. Myers and another is being initiated. The first was an attempt to understand the dispersal of *Nothofagus* pollen and the second involves the dispersal of pollen within and outside podocarp forest at Peel Forest, inland Canterbury.

Much remains to be done. The history of post-glacial vegetation is scarcely known in many areas e.g. North-west Nelson, South Island and Northland, North Island, and should be investigated. Besides the need to continue regional studies work on early post-glacial vegetation, and on later changes is required in greater detail than is presently available. A better appreciation of patterns of change during the last glaciation (Otiran), especially in respect to forest refugia, and of climatic fluctuations during that period, is necessary to understand more clearly the basis of existing patterns of vegetation. Another area, yet scarcely investigated, is a study of vegetation changes at interglacial-glacial and glacial-interglacial transitions. It seems, on existing data, that the interglacial-glacial transition is an abrupt one from forest to grassland-shrubland, a marked contrast to the glacial-interglacial transition from grassland through shrubland

to forest. This latter is especially well known at the beginning of the present inter-glacial (post-glacial).

An account of a project involving the origin of plants of arctic affinity in the Lake Superior flora, Canada, is presented by D. R. Given who in 1973 was a Canadian National Research Council Post-doctoral Fellow.

1. Pollen morphology (Dr N. T. Moar).

Studies of *Myosotis* (N. T. Moar) and Epacridaceae pollen (M. S. McGlone) are completed and are being prepared for publication. With these projects completed plans for an atlas of pollen grains of the native gymnosperms and dicotyledons were laid and work begun. Data for a number of groups is already available as are photomicrographs and electron micrographs of many pollen types. A provisional key has been prepared (M. S. McGlone) and is being tested during routine pollen analysis.

2. Quaternary research.

Detailed studies of the past vegetation and climate are being undertaken in central North Island, central South Island and in central Otago.

(a) Central North Island (Mr M. S. McGlone).

Present work is centred on areas near the Tongariro complex of volcanoes. Detailed work on the volcanic ashes of the region, their distribution and ages has recently been completed by Dr W. W. Topping of Victoria University. His work is of the greatest importance in this study as the peat, silt and loess deposits of the region always contain volcanic ash layers which provide useful correlation planes across considerable areas.

The pre-European vegetation of the region was mainly podocarp forest with beech and cedar at higher altitudes. However, in the past the vegetation cover has varied immensely according to the climatic regime. Between 20,000 and 15,000 years ago the most severe phase of the last glaciation (Otiran) occurred. Forest was eliminated from all but coastal sites in the lower half of the North Island, and very little vegetation would have persisted above 800 m. Not only was it a cold period, but probably a dry one also. The post-glacial history of the area consists of the reaction of the vegetation to increasing moisture and temperature. This trend probably peaked somewhere between 10,000 and 4,000 years ago and since then the trend has been towards increased cold and dryness. Two other very cold phases or stadials have been identified from the Otiran of this region. One occurred about 40,000 years ago, and the other is beyond radiocarbon dating, but is probably older than 60,000 years old. These stadials were separated by milder interstadial periods in which the climate permitted scrub and forest to grow above 600 m at least.

The next step in this work will be to investigate sites in Taranaki

and Hawkes Bay to see how the vegetation reacted to these climatic events at low elevations.

(b) Central Otago (Mr M. S. McGlone).

The sites looked at in Central Otago are all very much younger than those in the Tongariro area. Most date only from the ending of the Otiran some 14,000 years ago. The vegetation sequences discovered are the more or less normal South Island pattern of grassland-shrubland communities being replaced by podocarp forest. In some areas the podocarp is replaced by beech, but at the same time what must be natural fires begin to eliminate the forest cover over wide areas. At the moment only two dates are available and they suggest that fires occurred at least 2,500 years ago. It appears then, that European fires in the area are only the latest in a long series.

(c) Central South Island (Dr N. T. Moar).

Bands of sandy peat in eroded, well-weathered dune sand of Oturian (last Interglacial) age in cuttings in Wilson's Lead Road, Addisons Flat, just south of Westport have been studied intensively. At first it was concluded that the sequence represented cooling into the Otira Glacial and the pollen diagrams illustrating succession from shrubland to grassland tended to confirm this. However radiocarbon dates give a late Otiran, rather than an early Otiran age, for the peat, although contamination by younger carbon may be resulting in spurious dates. To be certain of the age a set of samples from several sites including both wood and peat were collected from previously dated bands and have been submitted for dating after rigorous extraction techniques.

Besides the trend from shrubland to grassland there is consistent evidence of a minor resurgence of *Nothofagus* which was repeated when the sites were resampled. On present evidence this event is older than 20,000 years and may be a response to the same events leading to the establishment of *Nothofagus* forest at Blue Spur Road, Hokitika, about 30,000 years ago. However, radiocarbon dates at this site may also be affected by contamination so that correlation is not yet secure. Nevertheless, at Blue Spur Road, and at one site along Wilson's Lead Road the pollen diagrams extend into the Aranuian (post-glacial) suggesting correlation with the late Otiran, rather than with the early Otiran.

The presence of *Nothofagus* forest during the Otiran at Hokitika is matched by the record of podocarp forest, including *Podocarpus spicatus,* from a peat buried in loess at Timaru, on the east coast of the South Island. According to early radiocarbon dates the 25 cm thick layer of peat spans 18,000 years; it began to accumulate on loess about 30,000 years ago and was overwhelmed by loess about 12,000 years ago. More recent work indicates that the peat is beyond the range of radiocarbon dating.

Other sites of Otiran age involving buried organic layers have been examined on both western and eastern coasts of central South Island.

Most, from mountain areas, were formed about 20,000 years ago and pollen analysis indicates that they accumulated under severe climatic conditions. Nevertheless, in some sites *Nothofagus* pollen is represented by as much as 7% of total pollen counted, and offers some evidence of relict *Nothofagus* forest at this time.

(d) The *Ascarina* decline (Mr M. S. McGlone, Dr N. T. Moar).

There are now enough pollen diagrams to suggest that *Ascarina lucida* and *Dodonaea viscosa* were formerly more frequent than they are today. *A. lucida* was abundant in the west of both islands between 10,000 and 5,000 years ago, but is now common only on the west coast of the South Island and in scattered localities in northern South Island and in the North Island. Pollen diagrams and radiocarbon dates suggest that *Ascarina* became progressively less frequent after about 5,000 years ago and was reduced to its present status about 1,800 years ago. *D. viscosa* suffered a similar reduction and it is suggested that these events were influenced by change to a frostier and droughtier climate beginning about 5,000 years ago.

(e) Subfossil charcoal (Dr B. P. J. Molloy).

Work has continued on a systematic survey of subfossil charcoal in forested and deforested soils, particularly in Canterbury, and the study of charcoal properties jointly with Dr K. M. Goh, Lincoln College. Preliminary results have been published.

Although the occurrence and effect of early Polynesian fires, 500 years ago, is still a feature of this work, more attention is being directed to natural fires and much information is being accumulated. As intimated in the 1969-71 Triennial Report, there is now firm evidence for a number of regional natural fires extending back into Late Glacial times. The use of this evidence in conjunction with palynological studies is proving valuable in vegetation reconstruction and history.

Other lines of continuing work include studies of charcoal production and distribution resulting from recent forest fires in the South Island, identification of charcoal in volcanic tephra (with Dr W. A. Pullar, Soil Bureau), and a systematic coverage of maori oven charcoal in eastern South Island (with Mr M. M. Trotter, Canterbury Museum).

In the past the identification of charcoal has been hampered by the lack of suitable identification keys. This situation should improve with the transfer of Mr R. N. Patel to this Division, and his continued publication on the anatomy of New Zealand woody species. A reference set of charcoal specimens is gradually being built up in conjunction with his studies.

(f) Origins of the arctic-alpine element at Lake Superior (Dr D. R. Given).

A little over 120 years ago Louis Agassiz, in the course of an adventurous exploration of Lake Superior with a group of geology

students, reported the occurrence of arctic plants on the north shore of the lake. He ascribed this to the exposed and inhospitable nature of the coastline and to the cool lake temperatures which in summer rarely exceed 10°C. Later collections extended the number and extent of species of arctic affinity and also revealed that numerous Cordilleran plants have easterly stations in the Lake Superior basin.

During 1973 I undertook a study of the present distribution, ecology and origin of these elements in the Lake Superior flora, as a Canadian N.R.C. Post-doctoral Fellow. With Dr James H. Soper field and herbarium work showed over 40 arctic-alpine species occur in the region, disjunct from other populations in the Arctic. Approximately the same number of Cordilleran species are also found round the lake. Most occupy shoreline habitats in a tundra-zone close to the water but some such as *Dryopteris fragrans* and *Saxifraga aizoon* extend onto inland bluffs. At two sites a remarkable assemblage of arctic-alpine plants occupy the floors of narrow canyons. Cold temperatures induced by unmelted ice throughout the summer allow species such as *Arenaria humifusa* and *Pyrola grandiflora* to thrive over 1,000 km south of the normal range.

Fernald suggested that the arctic-alpine element of the flora may have persisted on nunataks in the Lake Superior basin and others have suggested an origin by local migration from the "driftless area" of Wisconsin. Our studies and palynological evidence suggest that these plants are the relicts of a tundra zone developed adjacent to ice during Wisconsin glaciation. As ice retreated so did the tundra and with warmer climates the plants were restricted to only the most favourable sites. However, such factors as basement rock type have undoubtedly been important. The lack of tundra on the north side of the lake after 9,000 years B. P. is probably related as much to the unsuitability of acid igneous and plutonic rocks for colonisation by arctic species as to climatic change which has been postulated by Terasmae, Wright and others.

3. Modern pollen rain (Mr J. V. Myers).

In 1971 Tauber and Impact pollen traps were set up at Bankside Scientific Reserve, Canterbury and a year later traps of the same sort were established at the Eyrewell Scientific Reserve, Canterbury. The pollen trapping programme was initiated in order to understand better the dispersal of *Nothofagus* pollen, important in Quaternary studies, at sites 60 km (Bankside) and 14 km (Eyrewell) distant from the main pollen source. In addition we hoped to learn something about dispersal of other pollen types, including especially those of *Leptospermum scoparium* and *L. ericoides,* species which are usually insect pollinated. The traps were serviced once every two weeks.

At Bankside the percentages of *Nothofagus* pollen varied from as little as 0.5% of total pollen counted, to as much as 19% in the height of the flowering season. Eyrewell is much closer to the source areas and because of this the percentages of *Nothofagus* pollen were

consistently higher, reaching up to 45% of total pollen counted. The results of these studies gives us more confidence in interpreting the curves of *Nothofagus* pollen in our pollen diagrams.

The next step is to study the pollen rain at Peel Forest, inland Central Canterbury. Surface samples have already been collected beneath the canopy of different plant communities, and when these have been analysed sites will be selected for an intensive trapping programme which will begin in the 1976-77 flowering season. Later traps will also be set up at varying distances downwind from the forest to learn something of pollen dispersal of the various plants in the forest.

SEED

(Mrs M. J. A. Bulfin)

1. Seed germination.

With the additional space and facilities available since mid-1973, much more detailed work has been possible on the germination requirements of seeds of New Zealand species. The equipment available now includes, in addition to the usual incubating ovens, two Copenhagen germinating tanks (25°C) and five low temperature cabinets (0°, 5°, 10°, 12°, 15°C) housed in a cool room. In addition a prototype thermogradient plate with temperatures ranging from 0°C to 30°C is in use. The low temperature cabinets are used for pretreatment storage and also for germination tests. It was surprising to find that some species, e.g. *Neomyrtus pendunculata,* germinated at 0°C. Other species only germinate after a period in cold storage e.g. *Drosera arcturi* will only germinate after storage for at least 4 weeks at 5°, 10° or 12°C, with best results from 10°C pretreatment. In the past eighteen months seeds of 276 species have been tested with this range of treatments and of these there has been no success with seed of 94 species. Tests to determine the duration of viability of seeds are in progress and indications are that for some species there is a seasonal pattern of germination while others will germinate at any time of the year.

2. Seed identification.

Seeds have been identified from various sources for commercial firms, research workers and Government departments. Some examples are: impurities in seed crops; lamb pelts; paradise duck gizzard; kiwi gizzards; kapao droppings; archaeological sites; quaternary deposits. The continuing number of requests suggests the need for an atlas of seeds of New Zealand species, at least to generic level. With this

in mind some use has been made of the scanning electron microscope located in the Department of Botany, University of Canterbury to photograph smaller seeds for the study of surface markings and other characters.

3. Seed requests.

Overseas interest in seeds of New Zealand species continues with requests from botanical institutions and individuals for seeds of a wide range of species. There has been a sustained and unexplained interest in seeds of indigenous species of the insectivorous plants *Drosera* and *Utricularia*.

MORPHOLOGY AND ANATOMY

1. Juvenile forms (Mr E. J. Beuzenberg).

A long-term study of juvenility and heteroblastic development has been initiated in a variety of New Zealand plants.

2. Shoot initiation (Mr E. J. Beuzenburg with Dr J. D. Ferguson, Applied Biochemistry Division).

Although shoot initiation on excised roots is a rare event, it has been found recently in cultures of *Symphytum officinale* (comfrey) and *Lotus corniculatus* (birdsfoot trefoil). The origin of the shoots differs: in *Symphytum,* they arise from "nodules" along the root; in *Lotus,* they arise from callus at the cut end of the root but, if the culture medium contains glucose, the shoots then arise in clusters along the root. Anatomical studies show that each of these phenomena has a distinctive developmental pattern. Comparable events in other species known to reproduce vegetatively under natural conditions are now being investigated. Neither *Lotus* nor *Symphytum* normally reproduce vegetatively by the means described.

3. Embryology (Mrs M. N. Philipson).

A comparison was made between *Forstera* (Stylidiaceae) and *Donatia* on whose relationships conflicting views have long been held. Its position in or close to the Saxifragaceae is still upheld by some systematists, although others include it in the Stylidiaceae, or regard it as a distinct mono-generic family, the Donatiaceae, closely related to the Stylidiaceae. This study showed that *Donatia novae-zelandiae* closely resembles *Forstera tenella* in development of the ovule, megagametophyte and endospermal haustoria, providing further evidence to that already in the literature that the systematic affinities of *Donatia* are with the Stylidiaceae and not with the Saxifragaceae. In addition, the distinctive ovate nature of the pro-embryo reinforces

previously known floral and anatomical differences and it is concluded that the genus *Donatia* should be upheld as a distinct family (*N.Z. Journal of Botany 11:* 449, 1973).

4. Anatomy (Mr R. N. Patel).

(a) Study of the wood anatomy of the indigenous dicotyledons by their family groups has continued so that species can be identified and other significant comparisons made. Families under investigation are Pittosporaceae, Araliaceae, Viscaceae, Loranthaceae, Onagraceae (*Fuchsia*) and Papilionaceae (*Sophora*). Wood and botanical specimens of these families and of several others are being collected from various parts of New Zealand.

(b) Some anatomical work done at the Forest Research Institute, Rotorua has been written up for publication. It includes the descriptive wood anatomy of Santalaceae, Corynocarpaceae, Sapindaceae and Chloranthaceae. A paper on the bark anatomy of radiata pine, Corsican pine, and Douglas fir has also been prepared.

(c) About 120 wood specimens were received for identification during the past year.

(d) Earlier work by Dr E. J. Godley has shown that the bony endocarp of *Vitex lucens* (puriri) has four seed chambers, each having an aperture which is guarded by an oval door. The germinating seed can escape through an aperture if the door opens. The anatomy of puriri endocarp is being examined so that the way in which the doors open for the release of seeds is understood.

5. Electron microscope (Mr M. K. Reynolds).

The electron microscope laboratory is equipped with a Hitachi HU-11B transmission microscope with a vacuum coating unit, ultramicrotome and pyramitome as supporting equipment. The laboratory is a servicing unit for the DSIR centre at Lincoln and for other local organisations. Its work includes the study of leaf structure under desiccation by Applied Biochemistry Division, and the routine examination of viruses and bacteriophages for the Plant Diseases Division, DSIR and Lincoln College. For example, the classification of 22 bacteriophages has been confirmed by Mr C. K. Teh of Lincoln College.

The ultrastructure of the exine of pollen grains continues to be studied and micrographs of *Fuchsia* exine were prepared for Dr P. H. Raven's work on the Onagraceae.

CYTOLOGY AND GENETICS

1. Chromosome Atlas (Dr J. B. Hair, Mr E. J. Beuzenburg and Mrs B. E. Groves).

Prior to his retirement, Dr Hair concluded his survey of the chromosomes of *Celmisia* species of both New Zealand and Australia (n = 54, 108); *Abrotanella* (2n = 18); *Ourisia* (2n = 48); and the subantarctic Ranunculi (2n = 48). These results are now being assembled for publication.

Mr Beuzenberg and Mrs Groves published a survey of the chromosomes of the New Zealand mistletoes (Loranthaceae and Viscaceae) (*N.Z. Journal of Botany 12:* 211, 1974). In addition, Mr Beuzenberg has finalised his work on *Coprosma* (2n = 44, 88, 132, 220); *Senecio* (2n = 40, 80; 60; 100) (see Triennial Report 1969-71); *Scleranthus* (2n = 48) and *Homalanthus* (2n = 64).

2. *Rosa rubiginosa* (Dr B. P. J. Molloy, Mr E. J. Beuzenberg and Mr A. D. Campbell).

Progeny of open-pollinated wild plants of sweet brier (*Rosa rubiginosa*) have been grown for several years on the East Block area. More recent additions to this collection include transplants of *Rosa canina* and *R. micrantha* collected in the wild, and progeny of all three species, raised from seed gathered in Great Britain by Dr R. Melville.

Interest has centred on the relationship between chromosome number and morphological variation, pollen fertility, seed production, and ascorbic acid content of the hip flesh. All three species are pentaploid (2n = 35). However, somatic chromosome counts from our collection have shown a high degree of aneuploid and the occurrence of tetraploid and hexaploid plants within *R. rubiginosa.* All New Zealand plants of *R. canina* examined are hexaploid. A further season is needed to round off this study.

3. *Cortaderia* (Mr H. E. Connor).

The problem of the genetics of male sterility in native and foreign species of *Cortaderia* is still being pursued. In the naturalized species *C. selloana* (pampas grass) the problem remains somewhat intractable (see *Evolution 27:* 663, 1974). Interspecific F_1 hybrids between *C. selloana* and *C. araucana* yielded a 1 hermaphrodite : 1 female ratio; in F_2 from selfing of hermaphrodites a 3:1 ratio obtained, and F_2 from intercrossing F_1 females and hermaphrodites the ratio was 1:1. All these are orthodox ratios and indicative of simple genetic systems.

The sterile interspecific F_1 *C. araucana* (2n = 72) ♀ *X C. toetoe* (2n = 90) ♂ was relatively easily made. All plants that have come to flower during the last four years, 150 out of 250, are female; in a sample of this size it would be expected that if hermaphrodites are present some of them should have come to flower by now. No other family among the 225 families raised in these genetic experiments has behaved in such a manner. The androecium in these female plants is small with staminodes like those of *C. araucana* indicating that this state is dominant over the long, male sterile anthers in *C.*

toetoe. Such suppression of male fertility as seen in this hybrid may be an initial step in the development of the apomictic species in Section Cortaderia where apomicts outnumber the sexually reproducing species.

The ability to synthesize triterpene methyl ethers was shown to be under the control of dominant genes (Triennial Report for 1969-71). Further work with F_2 *C. araucana X C. selloana* has shown that synthesis of cylindrin and arundoin is controlled by a pair of linked, dominant genes. In this inter-specific hybrid the *C. araucana* parent synthesizes arundoin and cylindrin, and the *C. selloana* parent does not yield triterpene methyl ethers.

The triterpene methyl ether complement of the indigenous *C. splendens* is of interest in that within a family of plants from one seed parent there were plants synthesizing these triterpenoids and others that did not synthesize these compounds (*Phytochemistry 12:* 1196, 1973). Polymorphism of this sort had not been found in any other species we have examined. Individual chemotypes have been useful in studies to determine the genetic control of triterpene methyl ether synthesis.

In the last Triennial Report we briefly discussed the inheritance of α - and β - amyrin methyl ethers in hybrids between *C. richardii* and *C. toetoe;* it seemed exceptional in that it was, and still is, the only occasion when triterpene methyl ether synthesis was not controlled by dominant genes in F_1 hybrids. An F_2 population of 42 plants contained no one plant synthesizing these amyrin methyl ethers and all plants examined in a family derived from F_1 back-crossed to *C. toetoe,* contained both amyrin methyl ethers, much in the way the F_1 would have been expected to behave. We are still examining this apparent departure from the norm.

4. *Cortaderia* (Mrs M. N. Philipson).

In conjunction with the breeding work done in *Cortaderia,* a study of apomixis in *Cortaderia jubata* has been undertaken using both the optical and electron microscopes. For comparison, and to establish the normal pattern of development in sexually reproducing species, *C. richardii, C. fulvida, C. spendens* and *C. selloana* are also being investigated.

The need for the precise orientation of minute ovaries has resulted in the design of an apparatus which permits control of the solidification of wax while the object is being manipulated under the microscope. The epoxy resins normally used in embedding plant material for electron microscopy have proved unsatisfactory in *Cortaderia* but a styrene-methacrylate medium has overcome these difficulties.

5. Sex-ratio (Dr E. J. Godley).

The work on the sex-ratio of the dioecious Tasmanian endemic, *Clematis gentianoides,* mentioned in the last Triennial Report, has

been accepted for publication. From 20 wild plants 1941 seeds gave 367 males and 292 females. The trend towards an excess of males was not heterogeneous in the 20 progenies, two of which were significantly different from equality. The proportions of male plants could not be definitely related to percentage germination or death of seedlings. Earlier and later germinating groups had a similar sex ratio. Male plants produced more flowers than females and tended to flower earlier in age and earlier in the season. The heterogametic sex is not known.

6. Self-sterility in *Pseudowintera colorata* (Dr E. J. Godley and Miss D. H. Smith).

This work, which had just begun at the time of our last Triennial Report, is now substantially completed. Two cultivated plants, each well isolated, flower profusely but set very few fruits. These fruits have fewer seeds in relation to numbers of ovules, than is found in wild populations. Hand selfings of these plants produced no fruits, but intercrosses by hand were very successful in both fruit and seed production. One of the isolated plants was used as a female parent in hand crosses with five plants from a distant wild population at Kennedy's Bush, Banks Peninsula. All crosses were highly fertile.

GENERAL ADVISORY AND SERVICING WORK

Throughout this report there are several mentions of advisory work for other government departments, local bodies, private individuals etc.; and our representation on committees dealing with reserves or with National Parks, or on Nassella Tussock and Catchment Boards is another part of this service. More detailed examples are as follows:

1. Plant identification.

A large number of plants continue to be sent for identification, both to headquarters and substations particularly in the spring and summer. The majority are from government departments, principally the Farm Advisory, Research and Horticultural sections of the Ministry of Agriculture and Fisheries, but the New Zealand Forest Service, local authorities, universities, stock and station agents, agricultural firms, nurseries and private individuals also frequently request determinations and other advice about adventive, cultivated and indigenous plants. About 100 samples of algae were identified; most were seaweeds, some of which required precise determination because of their possible use as sources of agar. A number of inquiries concerned the nomenclature of cultivated plants and as the facilities

of the Library and Herbarium become better known, this work increases.

2. Forensic botany.

Identifications of drug plants and suspected drug plants continue to be made for the Police Department and Chemistry Division, DSIR. This is the responsibility of Mr A. E. Esler (Auckland), Dr I. A. E. Atkinson and Mr G. C. Kelly (Wellington) and Mrs M. J. A. Bulfin (Christchurch). The plant most frequently involved is marijuana, *Cannabis sativa*. At Auckland, for example, 62 samples of seed involving 46 cases were received on 29 days in 1973-74. There were 12 court appearances as an expert witness in Kaeo, Whangarei, Auckland, Otahuhu and Hamilton. It is hoped that these time-wasting court appearances will be replaced in new legislation by provision of a certificate of identification.

From time to time other criminal cases such as hit and run offences, sabotage, murder, attempted murder, rape, and illegal imports have involved identification of plant material.

3. Tree preservation (Mr W. R. Sykes and Dr B. P. J. Molloy).

Town planning procedures allow the specific protection by local authorities of specimen trees, rare trees, or trees that enhance the local environment. To assist in this recent development a pilot survey was made of all trees in two urban areas, Riccarton Borough and the Merivale district of Christchurch. Trees on every property were inspected and lists of several thousand trees considered worthy of preservation sent to the respective Councils.

4. Information and Editorial Service (Dr A. D. Thomson).

The older botanical records, often unpublished, such as descriptions of vegetation provide important data for present day researchers. A determined effort is being made to retrieve this data and retain copies in Botany Division Archives. Dr Leonard Cockayne was the most important early recorder of the vegetation and a complete bibliography of his work is being compiled. His extensive correspondence with colleagues both in New Zealand and overseas provides one of the most important insights into early New Zealand botany and supplements his published work. Thus an effort is being made to retrieve a substantial proportion of the extant Cockayne correspondence.

Botany Division co-operates with the Science Information Division of DSIR to produce the *N.Z. Journal of Botany* which is the main vehicle for the publication of botanical research in New Zealand. Two less formal journals have been published from the Division, namely *Beech Research News* and *Crop Research News*. The former was initiated in 1974 and is published under the auspices of the Scientific Co-ordinating Committee for Beech Research; three numbers have been produced and distributed to organisations and individuals interested in beech research. Seven numbers of *Crop*

Research News have been published by Botany Division since 1972 and they informally record the work of Crop Research Division, a sister Division at Lincoln. Because Botany Division staff are now stationed at Auckland, Lower Hutt, Nelson and Dunedin as well as at Lincoln it was decided in 1974 to distribute a Newsletter to provide a forum for staff and to record their activities, as well as maintain close links between staff members; ten numbers have been produced.

5. Latin diagnoses (Dr E. Edgar).

Fifty-two Latin descriptions were compiled for botanists at the Universities of Otago and Canterbury and the Plant Disease Division of DSIR.

BOTANICAL ILLUSTRATIONS

(Mr K. R. West)

Illustrations have been produced mainly for Botany Division and other DSIR units at Lincoln. Work has also been done for National Park Boards and bodies such as the Entomological Society of New Zealand (Inc.), the New Zealand Weed and Pest Control Society (Inc.) and the Scientific Co-ordinating Committee for Beech Research.

Reproductions have appeared in the following publications: *N.Z. Journal of Botany*; *N.Z. Journal of Agriculture*; *Beech Research News*; *Proceedings of the 27th N.Z. Weed and Pest Control Conference*; "The St Arnaud Range Nature Walk—Nelson Lakes National Park"; "Auckland Water Plants"—DSIR Information Series No. 92; "Lake Ellesmere"—DSIR Information Series No. 99; "Perspectives in Aphid Biology"; "Directory of New Zealand Entomology" etc.

Diagrams, maps, and drawings by successive assistants (largely by Mrs B. McCulloch) have been used by *Evolution*; *N.Z. Journal of Botany*; *Wellington Botanical Society Bulletin*; *Arctic and Alpine Research*; *Palaeoecology of Africa, the Surrounding Islands and Antarctica* etc.

The major effort of this period has been directed towards the production of the bulletin "The genus *Epilobium* (Onagraceae) in Australasia: a Systematic and Evolutionary Study" by Peter H. Raven and Tamra Engelhorn Raven, Missouri Botanical Garden and Washington University, St Louis, U.S.A. (Dr and Mrs Raven worked at Botany Division on a New Zealand National Research Advisory Council Senior Fellowship during 1969-70). Sixty-four taxonomic illustrations of species, subspecies and variant strains have been contributed—12 in water colour, the rest in line. Also 63 distribution

maps—3 in line, 60 in colour-line, and 14 miscellaneous maps, diagrams and drawings have been prepared. Six photographs, including a colour frontispiece, have been added to 18 provided by Dr and Mrs Raven and others. The cover has also been designed. Editorial work undertaken includes writing captions, proofing, paste-up, and seeing the bulletin through printing.

With continuing work in New Zealand on *Epilobium* after the Ravens' return to America it has been possible to further refine the concepts of many of the species. The recent discovery in Australia of another creeping *Epilobium* resulted in a re-appraisal of *E. brunnescens* (Cockayne) Raven et Engelhorn and allied species and a joint paper with Dr P. H. Raven is now in preparation. A short paper on new information about *Epilobium angustum* (Cheesem.) Raven et Engelhorn appeared in the *N.Z. Journal of Botany*.

An illustrated study of *Epilobium* cotyledons and seedlings is well advanced. Determinations of *Epilobium* specimens are frequently required by Divisional staff and others.

Displays of botanical illustrations have been presented for various purposes including a visit by the Minister of Science in 1972, INQUA in 1973, and the Royal Commonwealth Society in 1974.

Mrs Beverley McCulloch left in November 1973 after four years as Assistant Artist. Her work was much appreciated as was her lively contribution to the social life of the Campus. Her replacement, Mrs Vicki Vendetti left the Division in October 1974 and the position was filled by Miss Judith Mulholland.

The Division's collection of black and white photographs and the rapidly growing 35 mm colour slide collection have also been in the care of the Assistant Artist.

PUBLICATIONS

(January 1972—December 1975)

BIOLOGICAL FLORA

Macmillan, B. H. 1972: Biological flora of New Zealand 7. *Ripogonum scandens* J. R. et G. Forst. (Smilacaceae) supplejack, kareao. *New Zealand Journal of Botany 10:* 641-72.

TAXONOMY

Connor, H. E. and Edgar, Elizabeth 1974: Names and types in *Cortaderia* Stapf (Gramineae). *Taxon 23:* 595-605.

Drury, D. G. 1972: The cluster and solitary-headed cudweeds native to New Zealand: (*Gnaphalium* Section *Euchiton*—Compositae). *New Zealand Journal of Botany 10:* 112-79.

Drury, D. G. 1973: Annotated key to the New Zealand shrubby Senecioneae—Compositae and their wild and garden hybrids. *New Zealand Journal of Botany 11:* 731-84.

Drury, D. G. 1973: Nodes and leaf structure in the classification of some Australasian shrubby Senecioneae—Compositae. *New Zealand Journal of Botany 11:* 525-54.

Drury, D. G. 1974: A broadly based taxonomy of *Lagenifera* Section *Lagenifera* and *Solenogyne* (Compositae—Astereae), with an account of their species in New Zealand. *New Zealand Journal of Botany 12:* 365-95.

Drury, D. G. 1974: Illustrated and annotated key to the erechtitoid Senecios in New Zealand (Senecioneae—Compositae) with a description of *Senecio diaschides. New Zealand Journal of Botany 12:* 513-40.

Drury, D. G. 1975: A comparison of *Senecio kirkii* (New Zealand) and *Senecio insularis* (Lord Howe Island) and Senecios endemic to the island of St. Helena. *New Zealand Journal of Botany 13:* 769-80.

Edgar, Elizabeth 1973: Names in *Pseudopanax* C. Koch (Araliaceae). *New Zealand Journal of Botany 11:* 171-2.

Edgar, Elizabeth 1975: Australasian *Luzula. New Zealand Journal of Botany 13:* 781-802.

Galloway, D. J. 1974: A bibliography of New Zealand lichenology. *New Zealand Journal of Botany 12:* 397-422.

Galloway, D. J. and Jørgensen, P. M. 1975: *Erioderma sorediatum*, a new lichen from New Zealand. *Lichenologist 7:* 139-42.

Given, David R. 1972: *Pleurosorus rutifolius* (R.Br.) Fée (Aspleniaceae) in New Zealand. *New Zealand Journal of Botany 10:* 495-506.

Given, David R. 1972: The infra-specific taxonomy of *Celmisia spectabilis* Hook. f. (Compositae—Astereae). *New Zealand Journal of Botany 10:* 180-94.

Given, David R. 1973: *Damnamenia* gen. nov. a new Subantarctic genus allied to *Celmisia* Cass. (Astereae—Compositae). *New Zealand Journal of Botany 11:* 785-96.

Given, David R. 1975: *Celmisia spedeni* G. Simpson and *Celmisia thomsoni* Cheeseman—two rediscovered species. *New Zealand Journal of Botany 13:* 547-56.

Macmillan, B. H. and Chapman, E. M. 1971: F. Bryophyte collections at Canterbury Museum Christchurch (CANTY): pp. 705-6. G. Bryophyte collections at the University of Canterbury: p. 706. H. Bryophyte collections at Botany Division DSIR (CHR): pp. 707-8. *In* Bryophyte collections in New Zealand. *New Zealand Journal of Botany 9:* 699-710.

Mason, R. 1973: On two native *Ranunculi. Canterbury Botanical Society Journal No. 6:* 2-4.

Moore, Lucy B. 1972: New plant names. *Canterbury Botanical Society Journal No. 5:* 11-2.

Moore, L. B. 1973: Protogyny in *Hebe* "Paniculatae". *New Zealand Journal of Botany 11:* 173-6.

Moore, L. B. 1974: *Hypsela rivalis* and other pygmy plants. *Canterbury Botanical Society Journal No. 7:* 12-5.

Moore, L. B. 1975: Hybridism in *Cordyline* (Agavaceae). *New Zealand Journal of Botany 13:* 305-16.

Moore, L. B. and Mason, R. 1974: *Coprosma talbrockiei* sp. nov. and allied creeping species (Rubiaceae). *New Zealand Journal of Botany 12:* 137-48.

Moore, L. B. and Simpson, M. J. A. 1973: A new Myosotis from North-west Nelson. *New Zealand Journal of Botany 11:* 163-70.

Simpson, M. J. A. 1972: *Hebe lavaudiana. Journal of the Royal Horticultural Society 97:* 461-2.

Simpson, M. J. A. (Annotated by) 1973: Botanical notes. W. B. Brockie. *New Zealand Journal of Botany 11:* 581-4.

Simpson, M. J. A. 1973: Cushion raoulias of Canterbury. *Canterbury Botanical Society Journal No. 6:* 27-9.

Simpson, M. J. A. 1973: *Raoulia australis* Hook. f. on Banks Peninsula. *Canterbury Botanical Society Journal No. 6:* 4-6.

Simpson, M. J. A. 1974: *Senecio bifistulosus* Hook. f.—a rare shrub endemic to New Zealand. *New Zealand Journal of Botany 12:* 567-73.

Wardle, P. 1972: *Podocarpus totara* var. *waihoensis* var. nov.: the result of introgressive hybridisation between *P. totara* and *P. acutifolius. New Zealand Journal of Botany 10:* 195-201.

West, K. R. 1974: Notes on *Epilobium angustum* (Cheesem.) Raven et Engelhorn (Onagraceae). *New Zealand Journal of Botany 12:* 551-8.

Zotov, V. D. 1973: *Hierochloe* R.Br. (Gramineae) in New Zealand. *New Zealand Journal of Botany 11:* 561-79.

EXPERIMENTAL AND CHEMOTAXONOMY

Bailey, R. W. and Connor, H. E. 1972: Structural polysaccharides in leaf blades and sheaths in the arundinoid grass *Chionochloa. New Zealand Journal of Botany 10:* 533-44.

Bailey, R. W. and Connor, H. E. 1973: Structural carbohydrates in the arundinoid genus *Cortaderia. Phytochemistry 12:* 1197-8.

Connor, H. E. 1974: Breeding systems in *Cortaderia* (Gramineae). *Evolution 27:* 663-78.

Connor, H. E. and Bailey, R. W. 1972: Leaf strength in four species of *Chionochloa* (Arundineae). *New Zealand Journal of Botany 10:* 515-32.

Markham, K. R. and Godley, E. J. 1972: Chemotaxonomic studies in *Sophora* 1. An evaluation of *Sophora microphylla* Ait. *New Zealand Journal of Botany 10:* 627-40.

Purdie, A. W. and Connor, H. E. 1973: Triterpene methyl ethers of *Cortaderia splendens. Phytochemistry 12:* 1196.

Esler, A. E. 1973: Garden weeds. Oxalis species. Leaflet 4 pp.

Esler, A. E. 1973: Weeds in container mixes. *In* "Ministry of Agriculture and Fisheries, Nurserymen's Seminar, Container Mixes". Auckland. Pp. 5-8.

Given, David R. 1973: Naturalised flowering plants in south-west Fiordland. *New Zealand Journal of Botany 11:* 247-50.

Healy, A. J. (New Zealand Weed and Pest Control Society) 1969: "Standard Common Names for Weeds in New Zealand". Editorial Services Ltd., Wellington. 141 pp.

Healy, A. J. 1972: Weedy St. John's worts (*Hypericum* spp.) in New Zealand. *Proceedings of the Twenty-fifth New Zealand Weed and Pest Control Conference:* 180-90.

Healy, A. J. 1973: Introduced vegetation. *In* Williams, Gordon R. (Editor) "The Natural History of New Zealand". A. H. and A. W. Reed, Wellington. Pp. 170-89.

Healy, A. J. (member Committee on Noxious Weeds Administration) 1973: "Report of the Committee on Noxious Weeds Administration". Government Printer, Wellington. 66 pp.

Healy, A. J. 1973: Weeds in New Zealand. *Proceedings of the 4th Asian-Pacific Weed Science Society Conference, Rotorua 1:* 105-14.

Healy, A. J. 1973: Weeds in South Island retired high country—Is a weed problem likely? *Proceedings of Meeting on Future Use of Lands Retired from Grazing, 15-16 November 1972:* 102-6.

Healy, A. J. 1974: Identification of nightshades (*Atropa* and *Solanum*) in New Zealand. *Proceedings of the Twenty-seventh New Zealand Weed and Pest Control Conference:* 41-58.

Healy, A. J. 1974: Weeds hitch-hikers of the plant world. *The City Beautiful 55 (1) :* 12-4.

Healy, A. J. 1975: Field trip to North Canterbury. The Noxious Weeds Inspectors' Institute (Inc.) Annual Conference 1975. 18 pp.

Healy, A. J. 1975: Plant identification. *The Noxious Weeds Inspectors' Institute (Inc.) 1975 Conference Proceedings:* 61-5.

Healy, A. J. 1975: "Standard Common Names for Weeds in New Zealand". Additions and amendments. *Proceedings of the twenty-eighth New Zealand Weed and Pest Control Conference:* 281-8.

Healy, A. J. and West, K. R. 1974: Identification of storksbills (*Erodium* spp.). *Proceedings of the Twenty-seventh New Zealand Weed and Pest Control Conference:* 34-40.

Mason, R. 1974: Plants of two Canterbury cemeteries. *Canterbury Botanical Society Journal No. 7:* 36-40.

Mason, R. and West, K. R. 1973: Auckland water plants. *New Zealand Department of Scientific and Industrial Research Information Series No. 92:* 1-20.

Molloy, B. P. J. and Edgar, E. 1973: Another introduced sedge from Australia. *New Zealand Journal of Agriculture 126* (2) : 40-1, 43.

Northcroft, E. F. (Annotated by Healy, A. J.) 1975: Adventive flora of the Chatham Islands. *New Zealand Journal of Botany 13:* 123-9.

POISONOUS PLANTS

Astridge, S. J. and Esler, A. E. 1972: Poisonous plants. Castor oil, Oleander, Solanum, The Arums. Leaflets. 4 pp.

Astridge, S. J. and Esler, A. E. 1973: Poisonous plants. Hemlock. Leaflet. 4 pp.

Connor, H. E. 1974: Poisonous plants. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 4, part 46. Hamlyns Ltd., Hong Kong. Pp. 1285-91.

Esler, A. E. 1973: "Identification of Cannabis". Government Printer, Wellington. 8 pp.

Simpson, M. J. A. 1973: How does Cape honey flower affect birds? *Notornis 20:* 277-8.

Steward, Jose (Revised edition, edited by Connor, H. E.) 1975: "Plants in New Zealand Poisonous to Man". Government Printer, Wellington. 40 pp.

CULTIVATED PLANTS

Astridge, Sandra J. 1975: Cultivars of Chinese gooseberry (*Actinidia chinensis*) in New Zealand. *Economic Botany 29:* 357-60.

Healy, A. J. 1973: Historic and notable trees of New Zealand Part I—Their legal protection. *Royal New Zealand Institute of Horticulture Annual Journal No. 1:* 12-3.

Philipson, M. N. 1974: Identikit or know your rhododendrons. *Dunedin Rhododendron Group Bulletin No. 2:* 14-21.

Philipson, M. N. 1975: Introduced shrubs and small trees (1). *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 7, part 100. Hamlyns Ltd., Hong Kong. Pp. 2791-6.

Philipson, M. N. 1975: The *Lapponicum* rhododendrons. *Dunedin Rhododendron Group Bulletin No. 3:* 41-7.

Philipson, W. R. and Philipson, M. N. 1973: A history of Rhododendron classification. *Notes from the Royal Botanic Garden Edinburgh 32:* 223-38.

Philipson, Melva N. and Philipson, W. R. 1975: A new species of *Rhododendron* from Yunnan. *Notes from the Royal Botanic Garden Edinburgh 33:* 493-4.

Philipson, Melva N. and Philipson, W. R. 1975: A revision of *Rhododendron* Section *Lapponicum*. *Notes from the Royal Botanic Garden Edinburgh 34:* 1-71.

Sykes, W. R. 1973: Araucariaceae in New Zealand. *Royal New Zealand Institute of Horticulture Annual Journal No. 1:* 49-52.

Sykes, W. R. 1973: Gardening on the Canterbury Plains. *In* Beckett, Kenneth A. (Editor) "The Gardener's Bedside Book". B. T. Batsford Ltd., London. Pp. 234-43.

Sykes, W. R. 1974: The beautiful Kermadec pohutukawa. *Royal New Zealand Institute of Horticulture Annual Journal No. 2:* 43-6.

Sykes, W. R. 1975: Common broadleaf trees. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 7, part 91. Hamlyns, Hong Kong. Pp. 2539-47.

Sykes, W. R. 1975: Introduced shrubs and small trees (2). *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 7, part 102. Hamlyns Ltd., Hong Kong. Pp. 2842-7.

Thomson, A. D. 1975: Aspects of the early history of Government-sponsored plant breeding in New Zealand. *Crop Research News No. 17:* 12-4.

MORPHOLOGY AND ANATOMY

Patel, Rajni N. 1974: Wood anatomy of the dicotyledons indigenous to New Zealand 7. Santalaceae. *New Zealand Journal of Botany 12:* 431-44.

Patel, Rajni N. 1975: Bark anatomy of radiata pine, Corsican pine, and Douglas fir grown in New Zealand. *New Zealand Journal of Botany 13:* 149-67.

Patel, Rajni N. 1975: Wood anatomy of the dicotyledons indigenous to New Zealand 8. Corynocarpaceae. *New Zealand Journal of Botany 13:* 19-29.

Patel, Rajni N. 1975: Wood anatomy of the dicotyledons indigenous to New Zealand 9. Sapindaceae. *New Zealand Journal of Botany 13:* 131-40.

Patel, Rajni N. 1975: Wood anatomy of the dicotyledons indigenous to New Zealand 10. Chloranthaceae. *New Zealand Journal of Botany 13:* 141-8.

Philipson, W. R. and Philipson, M. N. 1973: A comparison of the embryology of *Forstera* L. and *Donatia* J. R. & G. Forst. *New Zealand Journal of Botany 11:* 449-59.

Tomlinson, P. B. and Esler, A. E. 1973: Establishment growth of woody monocotyledons native to New Zealand. *New Zealand Journal of Botany 11:* 627-44.

CYTOLOGY

Beuzenberg, E. J. 1975: Contributions to a chromosome atlas of the New Zealand flora—17. *Senecio* (Compositae). *New Zealand Journal of Botany 13:* 345-53.

Beuzenberg, E. J. and Groves, B. E. 1974: Contributions to a chromosome atlas of the New Zealand flora—16. Miscellaneous families. *New Zealand Journal of Botany 12:* 211-7.

Archer, A. C., Simpson, M. J. A. and Macmillan, B. H. 1973: Soils and vegetation of the lateral moraine at Malte Brun, Mount Cook region, New Zealand. *New Zealand Journal of Botany 11:* 23-48.

Astridge, Sandra 1974: The rain of pohutukawa seed. *Auckland Botanical Society Newsletter July 1974:* 14.

Atkinson, I. A. E. 1972: Vegetation and flora of Sail Rock, Hen and Chickens Islands. *New Zealand Journal of Botany 10:* 545-58.

Atkinson, I. A. E. 1973: Soils of Taita Experimental station. *New Zealand Department of Scientific and Industrial Research Bulletin 32:* 1-72.

Atkinson, I. A. E. 1975: A method for permanent transects in vegetation. *Tuatara 21:* 81-91.

Atkinson, I. A. E. 1975: Tongariro National Park. *In* Knox, Ray (Editor-in-Chief) "New Zealands Nature Heritage". Volume 6, part 85. Hamlyns Ltd., Hong Kong. Pp. 2371-7.

Atkinson, I. A. E. and Bell, B. D. 1973: Offshore and outlying islands. *In* "The Natural History of New Zealand". A. H. and A. W. Reed, Wellington. Pp. 372-92.

Atkinson, I. A. E. and Greenwood, R. M. 1972: Effects of the 1969-70 drought on two remnants of indigenous lowland forest in the Manawatu district. *Proceedings of the New Zealand Ecological Society 19:* 34-42.

Bulfin, M. J. A. 1972: Beech forest near Long Bay Road, Banks Peninsula. *Canterbury Botanical Society Journal No. 5:* 31-3.

Bulfin, M. J. A. 1972: *Myrsine nummularia* Hook. f. on Banks Peninsula. *Canterbury Botanical Society Journal No. 5:* 30-1.

Bulfin, M. J. A. 1973: Appendix A. List of mosses collected on the Owen and Lookout Ranges. *In* Bell, C. J. E. Mountain soils and vegetation in the Owen Range, Nelson 2. The vegetation. *New Zealand Journal of Botany 11:* 93-4.

Connor, H. E. 1973: Statement of existing research on retired land: (a) North Canterbury Catchment Board. *Proceedings of Meeting on Future Use of Lands Retired from Grazing, 15-16 November 1972:* 71-3.

Connor, H. E. 1973: Why land is retired: (b) Vegetation factors. *Proceedings of Meeting on Future Use of Lands Retired from Grazing, 15-16 November 1972:* 23-5.

Connor, H. E. 1974: High country catchments and agricultural interests: a commentary. *New Zealand Agricultural Science 8:* 126-30.

Druce, A. P. 1974: Rahui Island, Lake Waikareiti, Easter 1973. *Wellington Botanical Society Bulletin No. 38:* 39-42.

Druce, A. P. and Simpson, M. J. A. 1974: Flora of Gouland Downs, Mt Goul and Mt Perry, N.W. Nelson. *Wellington Botanical Society Bulletin No. 38:* 7-18.

Edgar, E. 1975: Rushes and sedges. *In* Knox, Ray (Editor-in-Chief)

"New Zealand's Nature Heritage". Volume 6, part 80. Hamlyns Ltd., Hong Kong. Pp. 2222-8.

Elder, Y. and Moore, L. B. 1973: What grows under the forest at Hanmer. *Canterbury Botanical Society Journal No. 16:* 13.

Esler, A. E. 1972: The living landscape. *In* Simpson, Frank (Editor) "Auckland Yesterday and Tomorrow". Auckland Institute and Museum, Auckland. Pp. 35-46.

Esler, A. E. 1974: In the footsteps of William Colenso at Blockhouse Bay, Auckland. *Auckland Botanical Society Newsletter November 1974:* 3-4.

Esler, A. E. 1974: The cabbage tree. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 1, part 14. Hamlyns Ltd., Hong Kong. Pp. 375-7.

Esler, A. E. 1974: The nikau palm. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 2, part 19. Hamlyns Ltd., Hong Kong. Pp. 532-4.

Esler, A. E. 1974: The pohutukawa. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 2, part 20. Hamlyns Ltd., Hong Kong. Pp. 549-53.

Esler, A. E. 1974: Vegetation of the sand country bordering the Waitakere Range, Auckland: The southern beaches. *Proceedings of the New Zealand Ecological Society 21:* 72-7.

Esler, A. E. 1975: Vegetation of the sand country bordering the Waitakere Range, Auckland: Piha Beach. *Proceedings of the New Zealand Ecological Society 22:* 52-6.

Esler, A. E. and Astridge, Sandra J. 1974: Tea tree (*Leptospermum*) communities of Waitakere Range, Auckland, New Zealand. *New Zealand Journal of Botany 12:* 485-501.

Esler, A. E. and Rumball, P. J. 1975: Gumland vegetation at Kaikohe, Northland, New Zealand. *New Zealand Journal of Botany 13:* 425-36.

Galloway, D. J. 1975: A profusion of alpine flowers. *New Zealand Alpine Journal 28:* 136-8.

Given, David R. 1972: Montane-alpine vegetation near Lake Shirley, Fiordland 2. Additions and corrections. *New Zealand Journal of Botany 10:* 559-72.

Given, D. R. 1975: Celmisias. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 7, part 92. Hamlyns Ltd., Hong Kong. Pp. 2567-72.

Given, David R. 1975: Conservation of rare and threatened plant taxa in New Zealand—some principles. *Proceedings of the New Zealand Ecological Society 22:* 1-6.

Given, D. R. 1975: Crepe ferns and other curiosities. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 6, part 79. Hamlyns Ltd., Hong Kong. Pp. 2210-6.

Given, D. R. 1975: Endangered plants. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 7, part 102. Hamlyns Ltd., Hong Kong. Pp. 2838-41.

Given, D. R. 1975: Ferns: An introduction. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 5, part 74. Hamlyns Ltd., Hong Kong. Pp. 2049-55.

Given, D. R. 1975: Filmy ferns. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 6, part 78. Hamlyns Ltd., Hong Kong. Pp. 2165-71.

Given, David R. and Soper, James H. 1975: Pioneer vegetation on moraines near Clachnacudainn Snowfield, British Columbia. *Syesis 8:* 349-54.

Given, D. R. 1975: Tree ferns. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 6, part 77. Hamlyns Ltd., Hong Kong. Pp. 2157-60.

Godley, E. J. 1975: Flora and vegetation. *In* Kuschel, G. (Editor) "Biogeography and Ecology in New Zealand". Chapter IV. Dr W. Junk, The Hague. Pp. 177-229.

Godley, E. J. 1975: Kowhais. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 5, part 65. Hamlyns Ltd., Hong Kong. Pp. 1804-6.

Hayward, B. W., Hayward, G. C. and Galloway, D. J. 1975: Lichens from northern Coromandel Peninsula, New Zealand. *Tane 21:* 15-27.

Johnson, P. N. and Campbell, D. J. 1975: Vascular plants of the Auckland Islands. *New Zealand Journal of Botany 13:* 665-720.

Johnson, P. N. and Nilsson, R. J. 1975: The forgotten Solander Islands. *Forest and Bird No. 195:* 2-5.

Macmillan, Bryony 1973: In a 90-years-old gum plantation on the Canterbury Plains. *Canterbury Botanical Society Journal No. 6:* 24-5.

Macmillan, Bryony 1974: Mosses and liverworts. *In* Metcalf, L. J. and Molloy, B. P. J. The vegetation of the summit of Little Mount Peel. *Canterbury Botanical Society Journal No. 7:* 32.

Macmillan, B. H. 1975: Lianes. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 5, part 67. Hamlyns Ltd., Hong Kong. Pp. 1875-80.

Mason, R. 1975: The macrophytes. *In* Jolly, V. H. and Brown, J. M. A. (Editors) "New Zealand Lakes". Auckland University Press, Auckland. Pp. 231-43.

Metcalf, L J. and Molloy, B. P. J. 1974: The vegetation of the summit of Little Mount Peel. *Canterbury Botanical Society Journal No. 7:* 29-32.

Moar, N. T. and Cunningham, B. T. 1975: Vegetation survey of the Tarawera River and environs, North Island, New Zealand. *New Zealand Journal of Botany 13:* 623-35.

Moar, N. T. and Mason, R. 1975: Discovery of *Utricularia protrusa* Hook. f. near Westport, South Island, New Zealand. *New Zealand Journal of Botany 13:* 803-5.

Molloy, B. P. J. 1973: More about *Ophioglossum*. *Canterbury Botanical Society Journal No. 6:* 26-7.

Molloy, B. P. J. 1975: Appendix A: List of plants—proposed Pukaki Village. *In* "Pukaki Tourist Village Planning Report". Department of Lands and Survey.

Molloy, B. P. J. 1975: Insects and seed production in *Celmisia*. *Canterbury Botanical Society Journal No. 8:* 1-6.

Molloy, B. P. J. 1975: Manuka and kanuka. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 6, part 89. Hamlyns Ltd., Hong Kong. Pp. 2469-74.

Moore, L. B. 1975: Hebes. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 6, part 77. Hamlyns Ltd., Hong Kong. Pp. 2133-8.

O'Connor, K. F., Connor, H. E. and Molloy, B. P. J. 1972: Response of four species of *Chionochloa* and two introduced grasses to soil amendment. *New Zealand Journal of Botany 10:* 205-24.

Purdie, A. W. 1975: Native brooms. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 6, part 84. Hamlyns Ltd., Hong Kong. Pp. 2329-35.

Simpson, M. J. A. 1974: *Spinifex hirsutus* in Canterbury. *Canterbury Botanical Society Journal No. 7:* 18-9.

Simpson, M. J. A. 1975: Orchids of Banks Peninsula. *Canterbury Botanical Society Journal No. 8:* 16-9.

Simpson, M. J. A. 1975: Tree daisies and allied species. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 5, part 69. Hamlyns Ltd., Hong Kong. Pp. 1913-8.

Thomson, A. D. 1975: The original publication of Leonard Cockayne's "New Zealand Plants and Their Story". *New Zealand Journal of Botany 13:* 807-9.

Wardle, P. 1972: New Zealand timberlines. *Tussock Grasslands and Mountain Lands Institute Review No. 23:* 31-48.

Wardle, P. 1972: Presidential Address: Ecologists and the environmental crisis. *Proceedings of the New Zealand Ecological Society 19:* 1-4.

Wardle, P. 1973: Native vegetation. *In* Williams, Gordon R. (Editor) "The Natural History of New Zealand". A. H. and A. W. Reed, Wellington. Pp. 155-69.

Wardle, P. 1973: New Guinea. Our tropical counterpart. *Tuatara 20:* 113-24.

Wardle, P. 1973: New Zealand timberlines. *Arctic and Alpine Research 5 (Part 2) :* A127-35.

Wardle, P. 1974: Alpine timberlines. *In* Ives, Jack D. and Barry, Roger G. (Editors) "Arctic and Alpine Environments". Chapter 7. Methuen, London, Pp. 311-402.

Wardle, P. 1974: Kahikatea. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 2, part 25. Hamlyns Ltd., Hong Kong. Pp. 695-9.

Wardle, P. 1974: Kamahi and tawhero. *In* Knox, Ray (Editor-in-Chief)

"New Zealand's Nature Heritage". Volume 2, part 27. Hamlyns Ltd., Hong Kong. Pp. 757-8.
Wardle, P. 1974: The kahikatea (*Dacrycarpus dacrydioides*) forest of South Westland. *Proceedings of the New Zealand Ecological Society 21:* 62-71.
Wardle, P. 1974: The totara. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 1, part 13. Hamlyns Ltd., Hong Kong. Pp. 347-50.
Wardle, P. 1974: Toatoa and Tanekaha. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 3, part 31. Hamlyns Ltd., Hong Kong. Pp. 871-2.
Wardle, P. 1975: Flax. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 6, part 79. Hamlyns Ltd., Hong Kong. Pp. 2206-9.
Wardle, P. 1975: Dwarf native conifers. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage" Volume 5, part 73. Hamlyns Ltd., Hong Kong. Pp. 2035-7.
Wardle, P., Mark A. F. and Baylis, G. T. S. 1973: Vegetation and landscape of the West Cape district, Fiordland, New Zealand. *New Zealand Journal of Botany 11:* 599-626.

NATIONAL PARKS AND RESERVES

Atkinson, I. A. E. 1973: Protection and use of the islands in Hauraki Gulf Maritime Park. *Proceedings of the New Zealand Ecological Society 20:* 103-14.
Atkinson, I. A. E. 1975: Tongariro National Park. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 6, part 85. Hamlyns Ltd., Hong Kong. Pp. 2371-7.
Connor, H. E. (Editor) 1973: "Mount Cook National Park" Fifth (revised) edition. Mount Cook National Park Board. 63 pp.
Druce, A. P. 1974: Some notes on the flora of Mt Egmont. *Auckland Botanical Society Newsletter July 1974:* 1-4.
Godley, E. J. 1972: " . . . In their natural state". Does planting achieve its purpose? *Forest and Bird No. 185:* 25-6.
Johnson, P. N. 1975: Fiordland National Park. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 7, part 100. Hamlyns Ltd., Hong Kong. Pp. 2797-800.
Kelly, G. C. 1972: 'Pelorus Bridge Scenic Reserve". Department of Lands and Survey. 6 pp.
Kelly, G. C. 1972: "Scenic Reserves of Canterbury". Biological Survey of Reserves, Report 2. 390 pp.
Kelly, G. C. 1974: Scenic reserves and the Nelson sector of the West Coast beech project. *Beech Research News No. 2:* 1-9.
Molloy, B. P. J. 1974: Preservation-botanical values. *Department of Horticulture Lincoln College Bulletin 16* (National Parks Authority —Rangers and Chief Rangers Block Course) : 57-9.
Molloy, B. P. J. and Ives, D. W. 1972: Biological reserves of New

Zealand 1. Eyrewell Scientific Reserve, Canterbury. *New Zealand Journal of Botany 10:* 673-700.

Simpson, M. J. A. 1973: Farewell Spit: valuable sanctuary and interesting botanical study. *Forest and Bird No. 190:* 19-21.

Simpson, M. J. A. 1974: Vegetation. *In* Host, Emily (Editor) "Nelson Lakes National Park". Nelson Lakes National Parks Board, Nelson. Pp. 50-63.

Simpson, M. J. A. and West, K. R. 1974: "The St Arnaud Range Nature Walk". Nelson Lakes National Park Board. 13 pp.

Wardle, P. 1974: Vegetation types at Fletcher Creek. *Beech Research News No. 1:* 7-8.

Wardle, P. 1975: Vascular plants of Westland National Park (New Zealand) and neighbouring lowland and coastal areas. *New Zealand Journal of Botany 13:* 497-545.

VEGETATION AND ANIMALS

Atkinson, I. A. E. 1973: A century of change within the New Zealand forest. *Forest and Bird No. 189:* 17-9, 22.

Atkinson, I. A. E. 1973: Spread of the ship rat (*Rattus r. rattus* L.) in New Zealand. *Journal of the Royal Society of New Zealand 3:* 457-72.

Atkinson, I. A. E. 1974: Bird habitats in New Zealand. *In* Robertson, C. J. R. (Editor) "Birds in New Zealand". Chapter 1. A. H. and A. W. Reed, Wellington. Pp. 11-27.

Bulfin, M. J. A. and Wardle, P. 1972: Deer and native plants and birds: menace affirmed. *The Christchurch Star, Letters to the Editor:* 3 April 1972.

VEGETATION HISTORY

Atkinson, I. A. E. and Swindale, L. D. 1974: Age determinations of some pre-historic lava flows in Hawaii. *Hawaii Agricultural Experiment Station Technical Bulletin No. 90:* 1-43.

Godley, E. J. 1973: Some aspects of New Zealand vegetation history. *The New Zealand Entomologist 5:* 239-40.

Godley, E. J. and Moar, N. T. 1973: Vegetation and pollen analysis of two bogs on Chiloé. *New Zealand Journal of Botany 11:* 255-68.

Goh, K. M. and Molloy, B. P. J. 1972: Reliability of radiocarbon dates from buried charcoals. *Proceedings of the 8th International Conference on Radiocarbon Dating 2:* 566-81.

Goh, K. M., Molloy, B. P. J. and Rafter, T. A. 1973: Radiocarbon dating of late Pleistocene loess from Banks Peninsula, New Zealand. *Ninth INQUA Congress, Christchurch 1973. Abstracts:* 126-7.

McGlone, M. S. 1973: Appendix. *In* Leslie, D. M. Relict periglacial landforms at Clarks Junction, Otago. *New Zealand Journal of Geology and Geophysics 16:* 584-5.

McGlone, M. S. 1973: Vegetation changes in the Otiran and Aranuian.

In "The New Zealand Quaternary: An Introduction". *Ninth INQUA Congress, Christchurch 1973.* Pp. 13-9.

McGlone, M. S. and Topping, W. W. 1973: Late Otiran/early Aranuian vegetation in the Tongariro area, central North Island, New Zealand. *New Zealand Journal of Botany 11:* 283-90.

McGlone, M. S. and Topping, W. W. 1973: Otiran pollen diagrams from Tongariro region, North Island, New Zealand. *Ninth INQUA Congress, Christchurch 1973. Abstracts:* 218-9.

Moar, N. T. 1973: A pollen diagram from a buried peat in loess at Timaru, South Island, New Zealand. *Ninth INQUA Congress, Christchurch 1973. Abstracts:* 245-6.

Moar, N. T. 1973: Contributions to the Quaternary history of the New Zealand flora 7. Two Aranuian pollen diagrams from Central South Island. *New Zealand Journal of Botany 11:* 291-304.

Moar, N. T. 1973: Late Pleistocene vegetation and environment in southern New Zealand. *In* Zinderen Bakker, E. M. van (Editor) "Palaeoecology of Africa and of the Surrounding Islands and Antarctica". Volume 8. Balkema, Cape Town. Pp. 179-98.

Moar, N. T. 1974: Pollen analysis and the history of vegetation and climate. *Tussock Grasslands and Mountain Lands Institute Review No. 30:* 26-32.

Moar, N. T. 1975: Appendix: Pollen analyses from the Sardine Terraces. *In* Nathan, Simon. Late Quaternary terraces between Ship Creek and the Whakapohai River, South Westland, New Zealand. *Journal of the Royal Society of New Zealand 5:* 323-7.

Moar, N. T. 1975: Peat. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 4, part 58. Hamlyns Ltd., Hong Kong. Pp. 1617-9.

Moar, N. T. and Gage, M. 1973: Interglacial deposits in Joyces Stream (S74), Waimakariri Valley, Canterbury. *New Zealand Journal of Geology and Geophysics 16:* 321-31.

Moar, N. T. and Suggate, R. P. 1973: Pollen analysis of late Otiran and Aranuian sediments at Blue Spur Road (S51), North Westland. *New Zealand Journal of Geology and Geophysics 16:* 333-44.

Molloy, B. P. J. and Cox, J. E. 1972: Subfossil forest remains and their bearing on forest history in the Rakaia Catchment. Canterbury, New Zealand. *New Zealand Journal of Botany 10:* 267-76.

Molloy, B. P. J., Goh, K. M. and Rafter, T. A. 1973: The age of Late Pleistocene loess on Banks Peninsula, Canterbury, New Zealand. *Ninth INQUA Congress, Christchurch 1973. Abstracts:* 247.

Myers, J. V. 1973: A note on the dispersal of *Nothofagus* pollen in Canterbury, New Zealand. *New Zealand Journal of Botany 11:* 311-6.

Nathan, Simon and Moar, N. T. 1973: Age and correlation of late Quaternary terraces in the lower Inangahua Valley, West Coast,

South Island, New Zealand. *Journal of the Royal Society of New Zealand 3:* 409-14.

Suggate, R. P. and Moar, N. T. 1974: The Otiran/Aranuian boundary. *New Zealand Journal of Botany 12:* 235-7.

Wardle, P. 1973: Variations of the glaciers of Westland National Park and the Hooker Range, New Zealand. *New Zealand Journal of Botany 11:* 349-88.

MARINE ALGAE

Parsons, Murray J. 1974: Marine phycology in New Zealand. *Phycologia 13:* 179.

Parsons, Murray J. 1975: Morphology and taxonomy of the Dasyaceae and the Lophothalieae (Rhodomelaceae) of the Rhodophyta. *Australian Journal of Botany 23:* 549-713.

Pickmere, Stuart Edward, Parsons, Murray Jury and Bailey, Raymond Wellesley 1973: Composition of *Gigartina* carrageenan in relation to sporophyte and gametophyte stages of the life cycle. *Phytochemistry 12:* 2441-4.

Pickmere, S. E., Parsons, M. J. and Bailey, R. W. 1975: Variations in carrageenan levels and composition in three New Zealand species of *Gigartina*. *New Zealand Journal of Science 18:* 585-90.

BOTANY OF PACIFIC ISLANDS

Parham, B. E. V. 1972: "Plants of Samoa". *New Zealand Department of Scientific and Industrial Research Information Series No. 85:* 1-162.

Sykes, W. R. 1975: The Kermadecs. *In* Knox, Ray (Editor-in-Chief) "New Zealand's Nature Heritage". Volume 4, part 59. Hamlyns Ltd., Hong Kong. Pp. 1641-7.

BIOGRAPHY

Moore, L. B. 1973: Thomas Kirk, botanist. *Tuatara 20:* 51-6.

Moore, Lucy B. 1975: A botanist remembers. *New Zealand Science Review 32:* 14-7.

Simpson, M. J. A. 1974: Walter Boa Brockie, N.D.H. (N.Z.), F.R.I.H. (N.Z.) 1897-1972 *New Zealand Journal of Botany 12:* 149-56.

Thomson, A. D. 1973: Robert Francis Ross McNabb (1934-72). *New Zealand Journal of Botany 11:* 799-802.

Thomson, A. D. 1974: Russell Morris Allison 1915-1974. *Crop Research News No. 16:* 7-12.

Thomson, A. D. 1975: Correction to the bibliography of the publications of Dr R. F. R. McNabb. *New Zealand Journal of Botany 13:* 577.

Druce, A. P. 1974: Review of "New Zealand Alpine Plants". *New Zealand Journal of Botany 12:* 423-7.

Esler, A. E. 1974: Review of "New Zealand Alpine Plants". *Wellington Botanical Society Bulletin No. 38:* 48-9.

Godley, E. J. 1972: When Joseph Banks was learning his craft. Review of "Joseph Banks in Newfoundland and Labrador, 1766". *The Press,* Christchurch. 18 March 1972.

Moar, N. T. 1973: Review of "Pollen and Spores of Chile: Modern Types of the Pteridophyta, Gymnospermae, and Angiospermae". *New Zealand Journal of Botany 11:* 389-90.

Molloy, B. P. J. 1975: Book Review: "Rush to Destruction". *The Press,* Christchurch. 19 April 1975.

Sykes, W. R. 1973: Review of "The Cultivation of New Zealand Trees and Shrubs". *Royal New Zealand Institute of Horticulture Annual Journal No. 1:* 68-9.

HONOURS AND AWARDS

Dr P. J. Garnock-Jones. Ph.D. (Cantuar.), 1975.

Dr D. R. Given. Fellow of the Linnean Society, 1973. National Research Council of Canada Post-doctoral Fellow, 1973.

Dr E. J. Godley. Royal Society of New Zealand Leonard Cockayne Memorial Lecturer for 1974. Title of lecture was "Leonard Cockayne and Evolution".

Dr P. N. Johnson. Ph.D. (Otago), 1973.

Dr Lucy B. Moore (retired). Sir Ernest Marsden Medal for Service to Science, 1974.

Dr G. N. Park. Ph.D. (A.N.U.), 1975.

Dr C. J. Webb. Ph.D. (Cantuar), 1975

OVERSEAS VISITS

Dr I. A. E. Atkinson visited Raoul Island for two days in July 1975.

Mr H. E. Connor visited herbaria in Europe during long-service leave from March to May 1973. Mr Connor also attended the XII International Botanical Congress (2 to 11 July 1975), Leningrad and later visited Europe and South America.

Dr D. J. Galloway who is presently seconded to the British Museum (Natural History) visited Scandinavia from August to September 1974 to examine lichen collections.

Dr D. R. Given while in Canada on a National Research Council

of Canada Post-doctoral Fellowship attended the following conferences: First International Congress of Systematic and Evolutionary Biology (4 to 12 August 1973, Boulder, Colorado); Seventh Conference on Numerical Taxonomy (9 August 1973, Boulder, Colorado); Fourth New England Fern Conference, Petersham, Massachusetts; Canadian Botanical Association Conference, London, Ontario. Dr Given also visited United Kingdom and Europe before returning to New Zealand via Kenya, Malaysia and Australia from January to April 1974.

Dr E. J. Godley visited Australia, Fiji, Hawaii, North America, England, Grand Canary Island, South America and Tahiti from May to September 1973.

Dr N. T. Moar attended Second SCAR Conference on the Quaternary of the Antarctica in Canberra from 9 to 12 August 1972. Dr Moar also visited Melbourne from 3 to 7 December 1974 to examine a candidate for the Ph.D. degree.

Dr M. J. Parsons attended the XII International Botanical Congress, Leningrad.

Mr R. N. Patel made a private visit to the United Kingdom and took the opportunity to attend an Applied Plant Anatomy Symposium in London from 26 to 27 July 1975.

Mr M. K. Reynolds attended the Eighth International Congress on Electron Microscopy at Canberra from 25 to 31 August 1974.

Mr W. R. Sykes accompanied the Soil Bureau, DSIR expedition to Cook Islands from June to August 1974. Mr Sykes also visited Raoul Island on 22 September 1974, Rarotonga in August 1975 and Niue in September 1975.

Dr P. Wardle attended meeting of Commission on High Altitude Geoecology at Calgary, Alberta from 1 to 8 August 1972 and also spent 4 days in California. Dr Wardle attended the XII International Botanical Congress, Leningrad and prior to the Congress visited Japan and returned to New Zealand via Kenya.

OVERSEAS VISITORS

Party of scientists from the Akademia Sinica, Peking, including Dr Chen Pang-yu, Kwangchow; Mr Th. Benedikz, Iceland; Dr D. Blaxell, Royal Botanic Gardens, Sydney; Dr H. T. Clifford, University of Queensland; Dr Lucy Cranwell and her husband Mr Watson Smith, Tucson, Arizona; Professor and Mrs J. Ewan, Tulane University, New Orleans; Dr S. M. Francis, Commonwealth Mycological Institute, Kew; Mr and Mrs Lee Haines, California; Dr M. Hommersand, University of North Carolina; Dr O. Moestrup and his wife Jette Lewinksy, University of Copenhagen; Col. G. L. Luthra, India; Dr J. D. Paxton, University of Illinois; Dr

Elizabeth Percival, Royal Holloway College, London and her husband Mr R. McDowall; Professor Carlos Muñoz, Museo Nacionalde Historia Natural, Santiago; Dr F. H. Perring, Biological Records Centre, Monks Wood, England; Dr P. van Royen, Bernice P. Bishop Museum, Honolulu; Dr Y. Saito, Hokkaido; Dr and Mrs P. Søndergaard, Milde Arboretum, Bergen; Dr G. Robin South, Memorial University, Newfoundland; Professor G. Ledyard Stebbins, Davis, California; Dr and Mrs C. G. G. J. van Steenis; Dr P. B. Tomlinson, Harvard Forest, Harvard University; Professor H. Vedel, Copenhagen; Dr N. Wace, Australian National University; Dr M. J. Wells, Department of Agriculture Technical Services, Pretoria; Dr R. A. White, University of Saskatchewan; Dr and Mrs J. H. Willis, Victoria; Dr and Mrs H. B. S. Womersley, University of Adelaide; Professor and Mrs Richard D. Wood, University of Rhode Island.

COMMITTEES AND APPOINTMENTS

Dr I. A. E. Atkinson. Fauna Protection Advisory Council; Outlying Islands Reserves Committee; Royal Society of New Zealand Conservation Committee.

Mrs M. J. A. Bulfin. Farewell Spit Scientific Advisory Committee.

Mr H. E. Connor. North Canterbury Nassella Tussock Board; North Canterbury Catchment Board (Chairman Water Committee); Mount Cook National Park Board.

Mr A. P. Druce. Scientific Advisory Panel, The Egmont National Park Board.

Mr A. E. Esler. Hon. Lecturer in Botany, University of Auckland.

Dr E. J. Godley. Hon. Lecturer, Lincoln College, University of Canterbury; Science Advisory Committee, Tongariro National Park Board; Board of Governors, The Miss E. L. Hellaby Indigenous Grasslands Research Trust; Chairman, Editorial Board, New Zealand Journal of Botany; Scenic and Allied Reserves Committee and Outlying Islands Reserves Committee, National Parks Authority (until 1973); Fauna Protection Advisory Council (until 1973); Member, Scientific Co-ordinating Committee for Beech Research.

Dr J. B. Hair. Triticeae Co-operative (U.S.A.); International Committee for Plant Chromosome Numbers (Canada).

Mr A. J. Healy. Interdepartmental Committee on Nassella Tussock.

Mr G. C. Kelly. Scenic and Allied Reserves Committee, National Parks Authority.

Miss R. Mason. Officials Committee on Eutrophication.

Dr N. T. Moar. Marlborough Nassella Tussock Board; Scientific Advisory Panel, Arthur's Pass National Park Board; New Zealand

National Committee for Quaternary Research, Royal Society of New Zealand; Organising Committee, IX Congress of International Union for Quaternary Research.

Dr B. P. J. Molloy. Organising Committee, IX Congress of International Union for Quaternary Research; Member, Peel Forest Park Board; Royal Society of New Zealand (Canterbury Branch) representative on Riccarton Bush Board of Trustees.

Dr G. N. Park. Farewell Spit Scientific Advisory Committee.

Mrs Melva N. Philipson. Council, New Zealand Rhododendron Association (Inc.).

Mr W. R. Sykes. Nomenclature Committee and Publications Committee, Royal New Zealand Institute of Horticulture.

Dr A. D. Thomson. President (1972) and Secretary, New Zealand Genetical Society.

Dr P. Wardle. Board Member and Convener of Scientific Advisory Panel, Westland National Park; President (1972) and Council Member (1973), New Zealand Ecological Society; Council Member Royal Society of New Zealand (Canterbury Branch).

RETIREMENTS AND RESIGNATIONS

Miss V. J. Gilmour, Typist from 29.11.71, resigned on 2.5.72.

Mrs J. Horner, Typist from 1.5.72, resigned on 25.8.72.

Mrs M. A. Leask, Library Assistant from 16.3.70, resigned on 31.5.73.

Mrs M. E. Jones, Typist from 11.9.72, resigned on 25.6.73.

Mrs B. A. McCulloch, Botanical Artist, from 21.10.71, resigned on 30.11.73.

Miss R. Mason, Scientist from 24.1.39, retired on 24.1.74.

Dr D. G. Drury, Scientist from 17.2.67, resigned on 31.1.74.

Miss E. M. Chapman, Technician from 16.2.70, resigned on 22.2.74.

Mrs B. E. Groves, Technical Officer from 14.10.64, resigned on 1.3.74.

Dr J. B. Hair, Scientist from 1.6.37, retired on 27.3.74.

Miss G. K. Carnielo, Typist from 13.8.73, resigned on 24.5.74.

Miss D. M. Hancock, Technician from 25.3.74, resigned on 9.8.74.

Mrs V. Vendetti, Botanical Artist from 26.11.73, resigned on 2.10.74.

Miss S. J. Astridge, Technician from 17.11.70, resigned on 28.1.75.

Miss J. M. Mulholland, Botanical Artist from 2.10.74, resigned on 28.2.75.

Mr T. W. Rawson, Scientist from 17.11.47, retired on 14.3.75.

Miss J. Watson, Botanical Artist from 6.3.75, resigned on 21.5.75.

Dr J. C. E. Hubbard, Scientist from 3.12.73, resigned on 4.6.75.

Mr D. J. Court, Scientist from 11.11.74, resigned on 4.7.75.

Mrs D. G. Kelly, Technical Officer from 1.4.69, resigned on 31.12.75.

TRANSFERS

Miss A. F. Davidson, Typist, to Department of Maori and Island Affairs, Christchurch on 17.7.72.

Dr D. J. Galloway, Scientist, from Applied Biochemistry Division, Palmerston North to Lincoln on 15.12.72.

Miss E. M. Richardson, Typist, to Chemistry Division, Christchurch on 10.9.73.

Mr G. C. Kelly, Scientist, to Substation at Lower Hutt on 31.3.75.

Mrs D. G. Kelly, Technical Officer, to Substation at Lower Hutt on 31.3.75.

Mr J. Thoms, Administrative Officer, to Christchurch Industrial Development Division on 9.5.75.

STAFF REPLACEMENTS

Miss S. Griffin	28.5.73	Library Assistant (Vice Mrs M. A. Leask).
Mrs A. L. Olsson	3.9.73	Typist (Vice Miss E. M. Richardson).
Miss P. M. Farrington	1.7.74	Typist (Vice Miss G. K. Carnielo).
Mrs P. C. M. Douglass	9.9.74	Technician (Vice Miss D. M. Hancock).
Miss P. Newton	17.10.74	Technician.
Miss J. Watson	6.3.75	Botanical Artist (Vice Miss J. M. Mulholland).
Dr P. J. Garnock-Jones	31.3.75	Scientist (Vice Dr D. G. Drury).
Dr C. J. Webb	31.3.75	Scientist (Vice Miss R. Mason).
Miss G. van Bree	16.6.75	Botanical Artist (Vice Miss J. Watson).
Mrs B. A. Matthews	21.7.75	Technician.
Miss S. Bowman	11.8.75	Technician (Vice Miss S. J. Astridge).
Miss J. E. Shand	18.8.75	Technician.
Mr J. A. Coleman	1.9.75	Administrative Officer (Vice Mr J. Thoms).

NEW POSITIONS

Miss L. Gordon	7.1.74	Library Assistant.
Mr S. R. June	27.5.74	Ecologist.
Dr G. N. Park	17.2.75	Ecologist.
Mr R. N. Patel	30.4.75	Wood Anatomist.
Mr G. Y. Walls	30.5.75	Technician.
Mr P. A. Williams	23.7.75	Ecologist.
Mr R. B. Allen	1.8.75	Technician.
Dr U. V. Cassie	8.9.75	Phycologist.

STAFF LIST

(1.4.75)

DIRECTOR: E. J. GODLEY, M.Sc. (N.Z.), Ph.D. (Cantab.), F.L.S., F.R.S.N.Z.

ASSISTANT DIRECTOR: H. E. CONNOR, M.Sc. (N.Z.)

Headquarters	E. J. GODLEY, M.Sc. (N.Z.), Ph.D. (Cantab.), F.L.S., F.R.S.N.Z. A. D. THOMSON, M.Sc. (N.Z.), Ph.D. (Cantab.) Miss D. H. SMITH
Botanical Artists	K. R. WEST Miss J. A. WATSON
Administrative Officer	J. THOMS
Typists	Miss P. M. FARRINGTON Mrs A. L. OLSSON
Library	Mrs M. E. BLACKMORE Miss S. GRIFFIN Miss L. GORDON
Handyman-Messenger	L. J. COOPER
Gardens and Vol. III Revision	A. J. HEALY, M.Agr.Sc. (N.Z.) I. C. BROWN J. KEENAN G. W. MANSON E. J. PURCELL D. SIMPSON E. V. WATSON
Taxonomy and Herbarium	H. E. CONNOR, M.Sc. (N.Z.) Miss E. EDGAR, B.A., M.Sc., Ph.D. (N.Z.), F.L.S. W. R. SYKES, B.Sc. (London), N.D.H. (R.H.S. London) D. J. GALLOWAY, M.Sc., Ph.D. (Otago) P. J. GARNOCK-JONES, B.Sc. (Hons.) (Wellington), Ph.D. (Cantuar.) D. R. GIVEN, B.Sc. (Hons.), Ph.D. (Cantuar.), F.L.S.

M. J. Parsons, M.Sc. (Wellington), Ph.D. (Adelaide)
Mrs M. N. Philipson, M.Sc. (N.Z.)
C. J. Webb, B.Sc. (Hons.), Ph.D. (Cantuar.)
Miss B. H. Macmillan
A. W. Purdie
Miss L. R. Stemmer
Mrs P. C. M. Douglass
Miss P. Newton

Ecology and Conservation

North Island

Auckland

A. E. Esler, M.Agr.Sc. (N.Z.)
D. J. Court, B.Sc. (Auckland)

Wellington

A. P. Druce, B.E. (N.Z.)
I. A. E. Atkinson, M.Sc. (N.Z.), Ph.D. (Hawaii)
G. C. Kelly, M.Sc. (Wellington)
Mrs D. G. Kelly, B.Sc. (Wellington), Dip. N.Z.L.S.

South Island

Lincoln

P. Wardle, M.Sc. (N.Z.), Ph.D. (Cantab.)
Mrs M. J. A. Bulfin, B.Sc. (N.Z.), Dip. Hort. (Massey)
B. P. J. Molloy, M.Sc. (N.Z.), Ph.D. (Cantuar.), Dip. Ag. (Massey)
A. D. Campbell

Dunedin

J. C. E. Hubbard, Ph.D.
P. N. Johnson, B.Sc., Ph.D. (Otago)

Nelson

G. N. Park, M.Sc. (Wellington), Ph.D. (A.N.U.)
S. R. June, M.Sc. (Massey)

Palynology and Morphology

N. T. Moar, M.Sc. (N.Z.), Ph.D. (Cantab.), F.L.S.
M. S. McGlone, M.Sc. (Wellington)
R. N. Patel, B.Sc. (Vallabh.), M.Sc. (London), Dip. For. (Oxon.)
E. J. Beuzenburg, Dip. Trop. Ag. (Deventer)
J. V. Myers
M. K. Reynolds (Electron Microscopist)